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ANIMAL INVESTIGATION PROGRAM 1976 ANNUAL REPORT: NEVADA TEST SITE AND VICINITY ,

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by

et al.

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(11)

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ABSTRACT

Data are presented from the radioanalysis of tissues collected from cattle and mule deer, desert bighorn sheep, feral horses, and other wildlife that resided on or near the Nevada Test Site during 1976. Routine activities and special investigations of the Animal Investigation Program are also discussed.

Other than the naturally occurring potassium-40, gamma-emitting radionuclides were detected infrequently with the exception of iodine-131 in animal thyroid samples collected after September 25 (the date of a nuclear test by the People's Republic of China).

Strontium-90 concentrations in bones from deer, cattle, and desert bighorn sheep continued the downward trend of recent years. Tritium concentrations were generally within ambient limits with the exception of animals exposed to sources of contamination; e.g., Sedan Crater, drainage ponds from Area 12 tunnels, etc.

Analysis of actinide in tissues was emphasized during 1976. Graphs illustrate the plutonium-239 levels in lungs, livers, and femurs from Nevada Test Site beef cattle for the years 1971 through 1976. Femur and lung residue data are nearly identical for each year with liver concentrations being a factor of 2 or 3 lower.

Hypothetical dose estimates to man were calculated on the basis of the daily consumption of 0.5 kilogram of liver or muscle from animals that contained peak actinide levels. The highest postulated dose was 11 millirem from tritium from tissues for a mule deer. This dose is about 2 percent of 500 millirems/year guide for radiation doses to an individual in the general public. All other postulated doses for consumption of the tissue containing other radionuclides are less than 0.1 percent of this guide.

The food habits of desert bighorn sheep were discussed according to the geographic locations of the animals at time of collection. Grasses made up approximately 60 percent of the diet at all locations, with shrubs content approaching 30 percent and the remainder consisting of various forbs.

The movement of 13 mule deer fitted with collars containing a radio-transmitter unit was monitored on a weekly basis. During the winter months, several deer did not leave the general area of their original capture while others moved over 50 kilometers to the Timber Mountain area.

No gross or microscopic lesions were found in necropsied animals that could be directly attributable to the effect of ionizing radiation.

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INTRODUCTION

During 1976, as since 1964, the U.S. Energy Research and Development Administration's* Nevada Operations Office assigned the responsibility for the operation of the Animal Investigation Program to the U.S. Environmental Protection Agency's Environmental Monitoring and Support Laboratory-Las Vegas. The basic objectives of this program are summarized as follows:

1. To conduct surveillance of domestic and wild animals on and around the Nevada Test Site to assess the radionuclide burden present in their tissue and to detect any pathological effects from the burdens.
2. To investigate alleged damage to domestic animals and wildlife resulting from the activities of the Nevada Operations Office of the U.S. Energy Research and Development Administration.
3. To maintain public relations through education and veterinary advice to the off-site population.
4. To conduct special ad hoc investigations.

Progress during 1976 in achieving these objectives and summaries of the data collected are presented in this report. Previous reports (Fountain 1961; Smith and Giles 1970, 1974, and 1975; and Smith et al., 1976, 1977a, 1977b, and 1978) have detailed the history, evaluation, and accomplishments of the Animal Investigation Program since its beginning in 1957.

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*Effective October 1, 1977, the U.S. Energy Research and Development Administration was designated the U.S. Department of Energy. Prior to January 19, 1975, the U.S. Energy Research and Development Administration was designated as the U.S. Atomic Energy Commission.

SAMPLE COLLECTION

Animals sampled during 1976 included cattle, feral horses, mule deer, rabbits, quail, chukar, and a coyote from the Nevada Test Site, and desert bighorn sheep that range the mountainous areas to the south and east of the Nevada Test Site. Animals sampled included those that died from natural causes or by accident, those collected through the cooperation of licensed hunters, as well as those that were sacrificed as part of the routine sampling activities of the Program.

Sacrificed animals were killed either by rifle or shotgun fire and were usually necropsied immediately after death and any gross pathological changes noted. Animals collected by other means were also necropsied if a prosector was available. If advanced postmortem changes had not occurred, the adrenals, eyes, heart, kidneys, liver, lungs, muscle, spleen, thyroid, gonads, and lesions (if any) were sampled and prepared for histopathological evaluation. Tissues collected for radioanalysis from large animals included rumen or stomach contents, liver, lung, tracheobronchial lymph nodes, muscle, thyroids, blood or urine, kidney, fetus (if present), and bone (femurs or hock). Tissues collected for radioanalysis from each rabbit included bone from entire skeleton, muscle, skin, testicles, entire gastrointestinal tract, and composited internal organs (liver, lung, kidneys, and spleen). Similar tissues were collected from the quail and chukar but, in order to provide sufficient volume for analysis, the same tissue samples from each species collected at the same time were composited.

Rumen contents from desert bighorn sheep were collected for botanical analysis. If fresh blood was available, heparinized samples were collected for hematological examination.

Cattle sampled during the year included 12 from the Nevada Test Site beef herd, 1 from the Area 15 dairy herd, and 3 from Area 5. Sampling information for all the cattle sampled is presented in table 1. Unless otherwise noted, each animal sampled spent its entire life grazing on the Area 18 range of the Nevada Test Site.

Figure 1 shows the locations of the herds and facilities. The management of the beef herd and soil and range surveys of the Area 18 grazing area have been published previously (Smith 1970, Leavitt 1970, and Brown and Mason 1968).

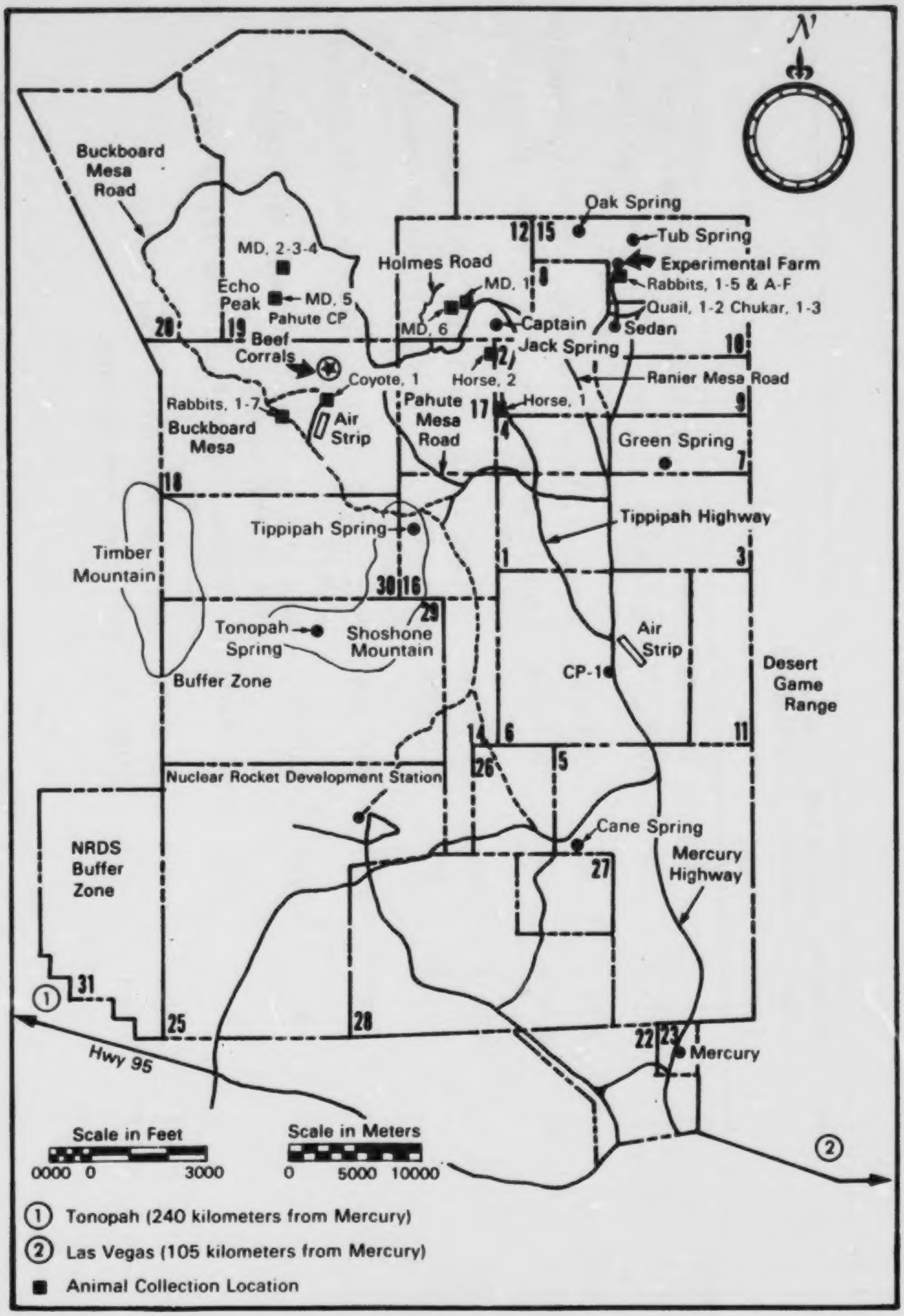
Tissue samples were collected from six Nevada Test Site mule deer (*Odocoileus hemionus*) during 1976. (See table 2 for sampling information.) Two of the deer were collected after being struck by a motor vehicle, and three died during a capture attempt. Collection locations are noted on figure 1.

Ten cottontail rabbits (*Sylvilagus audubonii*), one jackrabbit (*Lepus Californicus*), one coyote (*Canis latrans*), and several Gambel's quail (*Lophortyx gambeli*) and chukar (*Alectoris chukar*) were collected at the Area 15 farm. Other Nevada Test Site animals sampled included seven jackrabbits and two feral horses (*Equus caballus*).

Through the cooperation of State and Federal wildlife officials and participating hunters, tissue and/or rumen ingesta samples were collected from 30 mature desert bighorn sheep (*Ovis canadensis nelsoni*) rams during the annual hunt. The sampling information for these animals is presented in table 3 and the collection sites are shown in figure 2. Most of the animals were collected from Clark County in southern Nevada with 17 coming from the Desert National Wildlife Range or the Nellis Air Force Range which are contiguous to the Nevada Test Site. Two rams were collected from west-central Nevada near Lone Mountain in Esmeralda County.

TABLE 1. SAMPLING INFORMATION FOR NEVADA TEST SITE CATTLE, 1976

Animal No.	Sex	Age (yrs)	Breed	Weight (kg)	Date Sampled	Remarks
1	F	6	Hereford	436	04/08/76	Pregnant cow--8-month-old fetus.
2	F	1.75	Hereford	225	04/08/76	Beginning actinobacillosis.
3	M	9	Hereford	702	04/08/76	Steer in excellent condition.
4	M	3	Hereford	418	04/08/76	Steer in excellent condition.
5	M	2	Hereford	332	04/08/76	Steer in excellent condition.
6	M	3	Hereford	446	04/08/76	Steer in excellent condition.
7	M	3.5	Hereford	368	10/21/76	Steer in good condition.
8	F	2.5	Hereford	293	10/21/76	Very wild, in good condition, not pregnant but lactating.
9	F	14.5	Hereford	357	10/21/76	Aged, barren cow in fair condition with actinobacillosis.
10	M	0.5	Hereford	152	10/21/76	Bull calf in good condition.
11	M	0.5	Hereford	182	10/21/76	Bull calf in good condition.
12	M	0.5	Hereford	141	10/21/76	Bull calf in good condition.
A5-1	F	1.5	Hereford	186	05/06/76	Yearling heifer in fair condition. Wandered into Area 5 of NTS from off-site areas. In area ∿1 mo.
A5-2	F	8	Hereford	295	05/06/76	Mature cow in fair condition. Wandered into Area 5 of NTS from off-site areas. In area ∿1 mo.
A5-3	M	0.7	Angus-Cross	169	05/06/76	Steer calf in fair condition. Wandered into Area 5 of NTS from off-site areas. In area ∿1 mo.
286	F	2.5	Holstein	590	05/17/76	Dairy cow born and raised in Area 15. Was euthanized as was not responsive to treatment for progressive paralysis of the rear legs.


N
Buckboard Mesa Road
Oak Spring
Tub Spring
Experimental Farm
Rabbits, 1-5 & A-F
Quail, 1-2 Chukar, 1-3
Sedan
MD, 2-3-4
Holmes Road
MD, 1
Echo Peak
MD, 5
Pahute CP
MD, 6
Captain Jack Spring
Beef Corrals
Coyote, 1
Horse, 2
Ranier Mesa Road
Rabbits, 1-7
Buckboard Mesa
Air Strip
Pahute Mesa Road
Horse, 1
Green Spring
Tippipah Spring
Tippipah Highway
Timber Mountain
Tonopah Spring
Shoshone Mountain
Buffer Zone
Air Strip
CP-1
Desert Game Range
Nuclear Rocket Development Station
Cane Spring
Mercury Highway
NRDS Buffer Zone
Hwy 95
Mercury
12
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①
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Scale in Feet
0000 0 3000
Scale in Meters
0 5000 10000
① Tonopah (240 kilometers from Mercury)
② Las Vegas (105 kilometers from Mercury)
■ Animal Collection Location

Figure 1. Location of sampling sites and facilities on the Nevada Test Site.

TABLE 2. SAMPLING INFORMATION FOR NEVADA TEST SITE WILDLIFE, 1976

Animal No.	Sex	Estimated Age (yrs)	Estimated Weight (kg)	Date Collected	Remarks
Mule Deer-1	F	1	32	03/24/76	Road kill on N. Tunnel Access Road, Area 12.
Mule Deer-2	M	4 to 5	79	07/13/76	Collected Echo Peak, Area 19. Outfitted with radiotransmitter collar in 1975.
Mule Deer-3	F	2 to 3	40	08/06/76	Capture attempt fatality, Echo Peak, Area 19.
Mule Deer-4	M	3 to 4	64	08/12/76	Capture attempt fatality at trap site, Echo Peak, Area 19.
Mule Deer-5	F	3 to 4	45	08/18/76	Capture attempt fatality, U-19-V, Area 19.
Mule Deer-6	F	3 to 4	47	12/18/76	Road kill ½ mi. from G. Tunnel on Stockade Wash Road.
Horse-1	F	10+	350	04/13/76	Road kill 5 mi. N. of shaker plant on Tippipah Highway.
Horse-2	M	3	350	11/20/76	Road kill on Topopah Highway, near Captain Jack Spring turnoff.
Coyote	F	1	13	05/25/76	Collected Airport Road, Area 18, in good physical condition.
Quail-1 & 2	M & F	Mature	<0.3	09/09/76	Collected Microplots Area 15 farm.
Chukar-1, 2, & 3	M & F	Mature	<0.5	09/09/76	Collected Area 15 farm.

TABLE 2. SAMPLING INFORMATION FOR NEVADA TEST SITE WILDLIFE, 1976 (continued)

Animal No.	Sex	Estimated Age (yrs)	Estimated Weight (kg)	Date Collected	Remarks
Rabbit-1-A15	M	Mature	0.8	03/30/76	Cottontail, collected Area 15.
Rabbit-2-A15	F	Mature	0.9	03/30/76	Cottontail, collected Area 15.
Rabbit-3-A15	F	Mature	0.9	03/30/76	Cottontail, collected Area 15, pregnant.
Rabbit-4-A15	F	Immature	0.6	03/30/76	Cottontail, collected Area 15.
Rabbit-5-A15	M	Young	2.2	03/30/76	Jackrabbit, collected Area 15.
Rabbit-A-A15	F	Mature	<1	09/09/76	Cottontail, collected Area 15
Rabbit-B-A15	F	Mature	<1	09/09/76	Cottontail, collected Area 15.
Rabbit-C-A15	F	Mature	<1	09/09/76	Cottontail, collected Area 15.
Rabbit-D-A15	F	Mature	<1	09/09/76	Cottontail, collected Area 15.
Rabbit-E-A15	M	Mature	<1	09/09/76	Cottontail, collected Area 15.
Rabbit-F-A15	F	Mature	<1	09/09/76	Cottontail, collected Area 15. Apparent tapeworm cyst in subcutaneous tissue.
Rabbit-1-A18	M	Immature	1.4	05/25/76	Jackrabbit, collected Buckboard Mesa Road, Area 18.
Rabbit-2-A18	M	Mature	2.5	05/25/76	Jackrabbit, collected Airport Road, Area 18.
Rabbit-3-A18	F	Immature	1.5	05/25/76	Jackrabbit, collected Buckboard Mesa Road junction with 18-03, Area 18.
Rabbit-4-A18	F	Mature	2	05/25/76	Jackrabbit, collected 1 mi. S. of corrals, Airport Road, Area 18, lactating.
Rabbit-5-A18	F	Mature	1.9	05/25/76	Jackrabbit, collected 18-03 Road 2 mi. W. of corrals, lactating.
Rabbit-6-A18	M	Immature	1.7	05/25/76	Jackrabbit, collected W. of Airport Road, Area 18.
Rabbit-7-A18	F	Mature	2	05/25/76	Jackrabbit, collected Airport Road, Area 18, lactating.

TABLE 3. SAMPLING INFORMATION FOR DESERT BIGHORN SHEEP, 1976

Animal No.	Estimated Age (yrs)	Sex	Date Collected	Samples Collected	Remarks
1	8	M	11/21/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Mormon Peak, N. end of Range.
2	11	M	11/20/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Meadow Valley, N. end of Tri-Canyon. Desert National Wildlife Range (DNWR)*
3	7	M	12/18/76	Kidney, liver, lungs, rumen ingesta	Hunter kill, Quail Spring, DNWR.
4	10	M	11/20/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Las Vegas Range, S. end of Elbows, DNWR.
5	5	M	11/20/76	Bone, kidney, lungs	Hunter kill, Disappointment Canyon, DNWR.
6	10	M	11/21/76	Kidney, liver, lungs rumen ingesta	Hunter kill, Sheep Range, DNWR.
7	5	M	12/05/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Las Vegas Range.
8	7	M	12/02/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Black Mountain, Boulder Wash.
9	10	M	12/19/76	Kidney, liver, lungs, rumen ingesta	Hunter kill, Forlorn Hope.
10	8	M	12/07/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Mormon Mountains, Hackberry Spring.
11	5	M	11/28/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Black Mountain, Pinto Ridge.
12	8	M	11/27/76	Kidney, liver, lungs, rumen ingesta	Hunter kill, Lone Mountain.
13	7	M	11/20/76	Kidney, liver, lungs, rumen ingesta	Hunter kill, Eldorado Mountains, N. of Forlorn Hope.

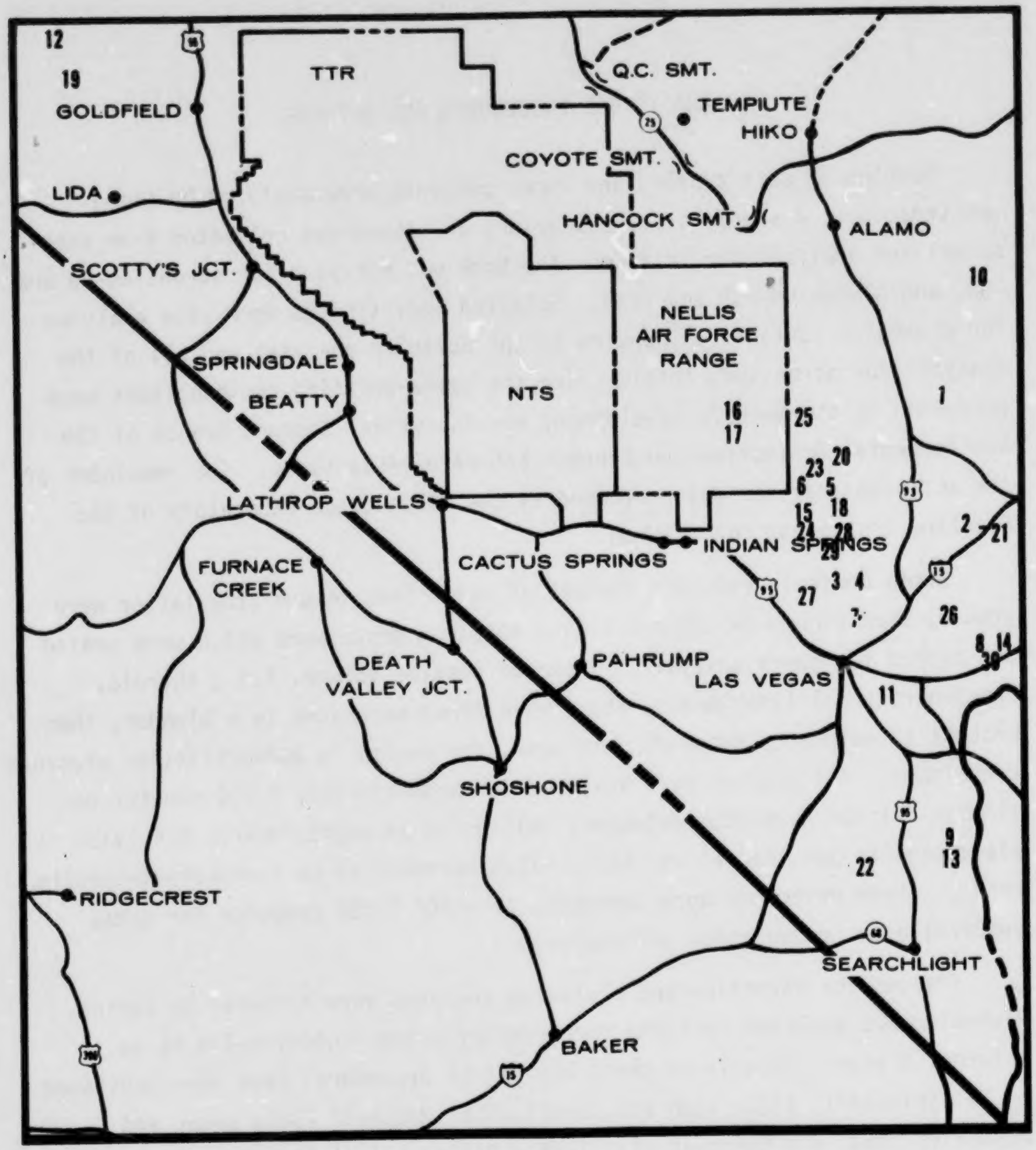
TABLE 3. SAMPLING INFORMATION FOR DESERT BIGHORN SHEEP, 1976 (continued)

Animal No.	Estimated Age (yrs)	Sex	Date Collected	Samples Collected	Remarks
14	5	M	12/07/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, S.W. of Cathedral Cove.
15	9	M	12/05/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Sheep Range, Dead Hills.
16	7	M	12/23/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Quartz Spring, DNWR.
17	11	M	12/27/76	Kidney, liver, lungs, rumen ingesta	Hunter kill, Pint Water Range, S. of Tim Spring.
18	5+	M	12/13/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Sheep Range, Shale Cut Spring.
19	8	M	11/24/76	Bone, kidney, liver, lungs, rumen ingesta	Hunter kill, Alpine Mine Area, DNWR.
20	11	M	12/07/76	Bone, kidney, liver, lungs	Hunter kill, Sheep Range, Cherry Canyon, DNWR.
21	10	M	12/18/76	Rumen ingesta	Hunter kill, Meadow Valley, Tri-Canyon, DNWR.
22	7	M	12/04/76	Rumen ingesta	Hunter kill, Highland Range, DNWR.
23	8	M	11/23/76	Rumen ingesta	Hunter kill, Sheep Range, Mule Deer Ridge, DNWR.
24	9	M	11/23/76	Rumen ingesta	Hunter kill, Sheep Range, Cow Camp Spring, DNWR.
25	10	M	12/07/76	Rumen ingesta	Hunter kill, N.W. Sheep Range, Rug Mountain, DNWR.
26	6	M	12/07/76	Rumen ingesta	Hunter kill, Muddy Mountains, DNWR.
27	7	M	12/12/76	Rumen ingesta	Hunter kill, S.W. Sheep Range, Joe May Canyon, DNWR.

TABLE 3. SAMPLING INFORMATION FOR DESERT BIGHORN SHEEP, 1976 (continued)

Animal No.	Estimated Age (yrs)	Sex	Date Collected	Samples Collected	Remarks
28	9	M	11/20/76	Rumen ingesta	Hunter kill, S.W. Sheep Range, Quijinump Spring, DNWR.
29	9	M	11/23/76	Rumen ingesta	Hunter kill, S.W. Sheep Range, Wagon Spring, DNWR.
30	8	M	11/23/76	Rumen ingesta	Hunter kill, Black Mountain, Cathedral Cove.

* DNWR = U.S. Desert National Wildlife Range.


12
19
GOLDFIELD
LIDA
SCOTTY'S JCT.
SPRINGDALE
BEATTY
TTR
NTS
Q.C. SMT.
TEMPIUTE
HIKO
COYOTE SMT.
HANCOCK SMT.
ALAMO
NELLIS AIR FORCE RANGE
10
1
16
17
25
23
20
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5
15
18
24
28
29
2
21
3
4
27
7
26
8
14
30
11
LATHROP WELLS
CACTUS SPRINGS
INDIAN SPRINGS
FURNACE CREEK
DEATH VALLEY JCT.
PAHRUMP
LAS VEGAS
SHOSHONE
RIDGECREST
22
9
13
SEARCHLIGHT
BAKER
93
95
15

Figure 2. Approximate collection sites of 1976 desert bighorn sheep.

ANALYTICAL PROCEDURES AND METHODS

Samples of soft tissues and rumen contents were analyzed by gamma spectroscopy. A sample of blood, urine, or tissue was collected from each animal and analyzed for tritium. The bone was analyzed for strontium-89 and -90, and plutonium-238 and -239. Selected soft tissues were also analyzed for plutonium content. A portion of the actinide analyses and all of the analyses for strontium, tritium, and the gamma-emitting radionuclides were performed by the Methods Development and Analytical Support Branch of the Environmental Monitoring and Support Laboratory-Las Vegas. The remainder of the actinide analyses was performed by the Albuquerque Laboratory of the Eberline Instrument Corporation.

Rumen contents and soft tissues of sufficient volume (the latter were ground) were placed in 200-milliliter aluminum containers which were sealed and stored for gamma analysis. Those of smaller volume, i.e., thyroid, tracheobronchial lymph nodes, etc., were first macerated in a blender, then brought to volume by suspending in agar, and sealed in 200-milliliter aluminum containers. All samples were analyzed for approximately 1,200 minutes on lithium-drifted germanium detectors calibrated at approximately 0.5 kiloelectronvolts per channel in the 60-kiloelectronvolts to 2-megaelectronvolts range. These detectors were connected to a PDP 11/20 computer for gamma spectral data accumulation and analysis.

Tissues for strontium and plutonium analyses were prepared by ashing. Plutonium was analyzed by alpha spectroscopy using plutonium-236 as an internal tracer. Details of these analytical procedures have been published by Talvitie 1971, 1972; Wish and Rowell 1956; Mitchell 1960; Hagan and Arrhenius 1963; and Major et al., 1975. Other radionuclide analytical procedures used at the Environmental Monitoring and Support Laboratory-Las Vegas were described previously (Johns 1975).

Quality assurance samples were included in each group of samples submitted for plutonium analyses. These were either duplicate samples collected from sacrificed animals and submitted under a blind identification number or similar tissue samples purchased at a local market and to which a known amount of plutonium was added. The data from the former type of quality assurance samples are included in the data tables of the appendixes while the data from the spiked samples are presented in table 4.

TABLE 4. QUALITY ASSURANCE RESULTS

Tissue	ACTIVITY ADDED		ACTIVITY REPORTED	
	^{238}Pu (pCi/Sample)	^{239}Pu (pCi/Sample)	^{238}Pu (pCi/Sample)	^{239}Pu (pCi/Sample)
Liver	0.536	1.487	1.5 ± 0.75	3.5 ± 1.25
Liver	0.536	3.457	0.514 ± 0.257	3.855 ± 0.514
Liver	0	0	<0.618	<0.618
Liver	0	1.34	<0.568	1.704 ± 0.568
Liver	0.536	0	<0.500	<0.500
Muscle	0.536	0.992	<0.744	1.116 ± 0.372
Muscle	0	0	<0.348	<0.348
Muscle	0.536	0.67	<0.148	0.666 ± 0.222
Muscle	0	0	<0.446	0.669 ± 0.223
Muscle	0.536	3.35	0.46 ± 0.23	3.45 ± 0.69

The activity values for plutonium-239 listed in this report are actually the sum of the individual isotopic activities of plutonium-239 and -240. The alpha emissions of these two isotopes cannot be separately identified (resolved) by alpha spectrometric analysis.

All data are reported with the 95 percent confidence level counting error and are corrected to time of sample collection. Results which show a net sample activity less than the two-sigma counting error are reported as less than the activity calculated. That activity in this report is defined as the minimum detectable activity. The approximate minimum detectable activities and analytical procedures are summarized in appendix A.

Tissue and lesion samples collected for histopathological examination were first fixed with a 10-percent Formalin® solution. They were then dehydrated with alcohol and embedded in paraffin prior to sectioning with a microtome. A 5-micrometer section was placed on a glass slide, stained with hematoxylin and eosin, and delivered to a pathologist for interpretation.

When fresh blood was available, 2 milliliters was withdrawn from the jugular vein and placed in a heparinized tube, and two blood-smear slides were made. These were airmailed to the ICN Medical Laboratories, Inc., of Portland, Oregon, where a complete blood-cell count was made.

Botanical analyses of the rumen-content samples were accomplished by washing random aliquots of the ingesta with water. After washing, the samples were each placed in a shallow pan and suspended in water. Identification of the vegetation was completed by examining each fragment with the aid of a binocular microscope. Following the identification, a visual estimate of the percentage composition for each species was made and recorded. The shrubs and forbs were identified according to Munz and Keck (1965) and McMinn (1964), and the grasses according to Hitchcock (1950).

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RESULTS AND DISCUSSION

NEVADA TEST SITE CATTLE

The analytical results from tissues collected from the Area 18 Nevada Test Site beef cattle during April and October are presented in the tables of appendix B. Data from other Nevada Test Site cattle are presented in appendix C.

The only gamma-emitting radionuclide that was consistently detected was the naturally occurring potassium-40. Occasionally, detectable levels of cesium-137 were found in the rumen contents and soft tissues. The highest level reported was 41 ± 4.7 picocuries/kilogram found in kidney from a 3-year-old Hereford steer sampled in April of 1976. Zirconium-95 (650 ± 110 picocuries/kilogram) was detected in only one rumen sample. Detectable levels of iodine-131 were found in the thyroids from all six animals sampled in October. These values, ranging from 21 to 150 picocuries/gram and the zirconium-95 value mentioned previously, were probably the result of an atmospheric nuclear test conducted by the People's Republic of China on September 25 at 2200 hours PDT (Monitoring Operations Division 1977).

Tritium levels were nondetectable in the blood collected from the Area 18 beef cattle and the Area 15 dairy cow. Blood from two of the three Area 5 animals contained 250 and 270 picocuries/liter, respectively. For comparison purposes the average tritium values in Beatty and Hiko, Nevada, were less than 400 picocuries/liter of atmospheric water as reported by the Monitoring Operation Division (1977).

As shown in figure 3, strontium-90 values in femur samples from the beef herd grazing Area 18 averaged 4.1 picocuries/gram of bone ash which is consistent with values reported in recent years and reflects the general downward trend observed since the cessation of atmospheric nuclear tests. Again, as

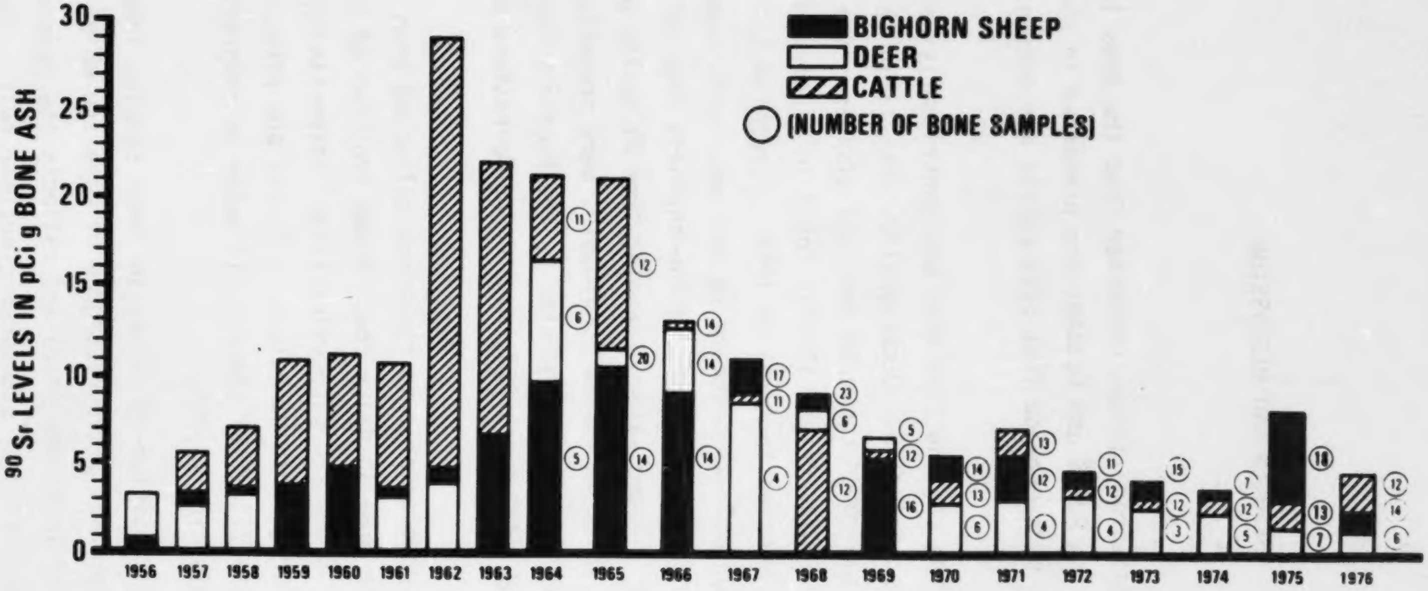

Figure 3. Annual averages of ^{90}Sr in bones of cattle, deer, and desert bighorn sheep 1956-1976.

in previous years, the peak strontium-90 value reported (11 picocuries/gram of ash) was from an aged animal (a 14.5-year-old cow). Strontium-89 was detected in femurs from only two animals. Because the reported concentrations of strontium-89 are so near the detectable level (less than the two-sigma counting error) in each case, they are probably not statistically significant.

Plutonium-238 is present in the environment primarily as a result of the burnup of the SNAP-9A power source (Krey and Krajewski 1972; Hardy et al., 1972). The expected ratio of plutonium-239 to plutonium-238 is roughly 25. It has been postulated (Patterson et al., 1974; and Matlock et al., 1976) that plutonium-238 may be more rapidly solubilized and thus potentially more mobile under environmental conditions than is plutonium-239. Thus, it is possible that the plutonium 239:238 ratios for animal tissue (intake results are in part from plutonium uptake by plants) may be lower than the ratios for fallout and soil. Data tables in appendixes B and C tend to support this assumption as the expected ratio of 25 was seldom reached. The ratios are highly variable even from similar tissues but generally were less than 10. Moreover, unpublished data from soil samples collected on and around the Nevada Test Site by the Monitoring Operations Division, the Environmental Monitoring and Support Laboratory - Las Vegas, generally show plutonium 239:238 ratios of less than 10. Only occasional soil samples are reported in the 20 to 25 range.

The median values of actinide data from the tables in appendixes B and C are summarized in table 5. The increased actinide levels observed in rumen contents during October were also noted in 1973, 1974, and 1975. This may be related to the range conditions at that time of the year, i.e., forage was scant and dry, and more soil was probably ingested during the grazing process.

Figures 4, 5, and 6 show comparisons of plutonium-239 levels in lungs, livers, and femurs from the Area 18 beef herd from the years 1971 through 1976. As there is considerable overlapping of the ranges reported, no clear trends are readily apparent and levels reported appear to have remained relatively constant. Femur and lung data are nearly identical for each year with liver generally being a factor of 2 or 3 lower.

TABLE 5. MEDIAN VALUES OF PLUTONIUM CONCENTRATIONS IN SELECTED TISSUES FROM NEVADA TEST SITE CATTLE (pCi/kg wet wt.)

Tissue	ISOTOPE AND HERD SAMPLED							
	^{238}Pu				^{239}Pu			
	Area 15[a]	Area 15[b]	Area 5[c]	Area 15[d]	Area 15[a]	Area 15[b]	Area 5[c]	Area 15[d]
Lungs	0.33	0.25	<0.03	0.13	1	1.2	0.48	0.1
Tracheobronchial Lymph Nodes	<5	<0.35	<1.4	NC	6.9	<0.5	<1.6	NC
Muscles	<0.06	<0.03	<0.02	0.11	<0.08	<0.03	<0.02	0.41
Livers	<0.085	0.4	0.15	<0.06	<0.11	1.2	0.34	0.43
Rumen Contents	0.3	0.87	NC	NC	0.9	4.6	NC	NC
Reticulum Sediments	3.9	3.6	NC	NC	24	150	NC	NC
Femurs	<0.53	0.51	<0.05	12	1.04	<1.1	<0.05	<0.59

[a] Area 18 beef cattle sampled in April
[b] Area 18 beef cattle sampled in October
[c] Area 5 beef cattle sampled in May
[d] Number 286--a dairy cow sampled in May
NC = Not collected

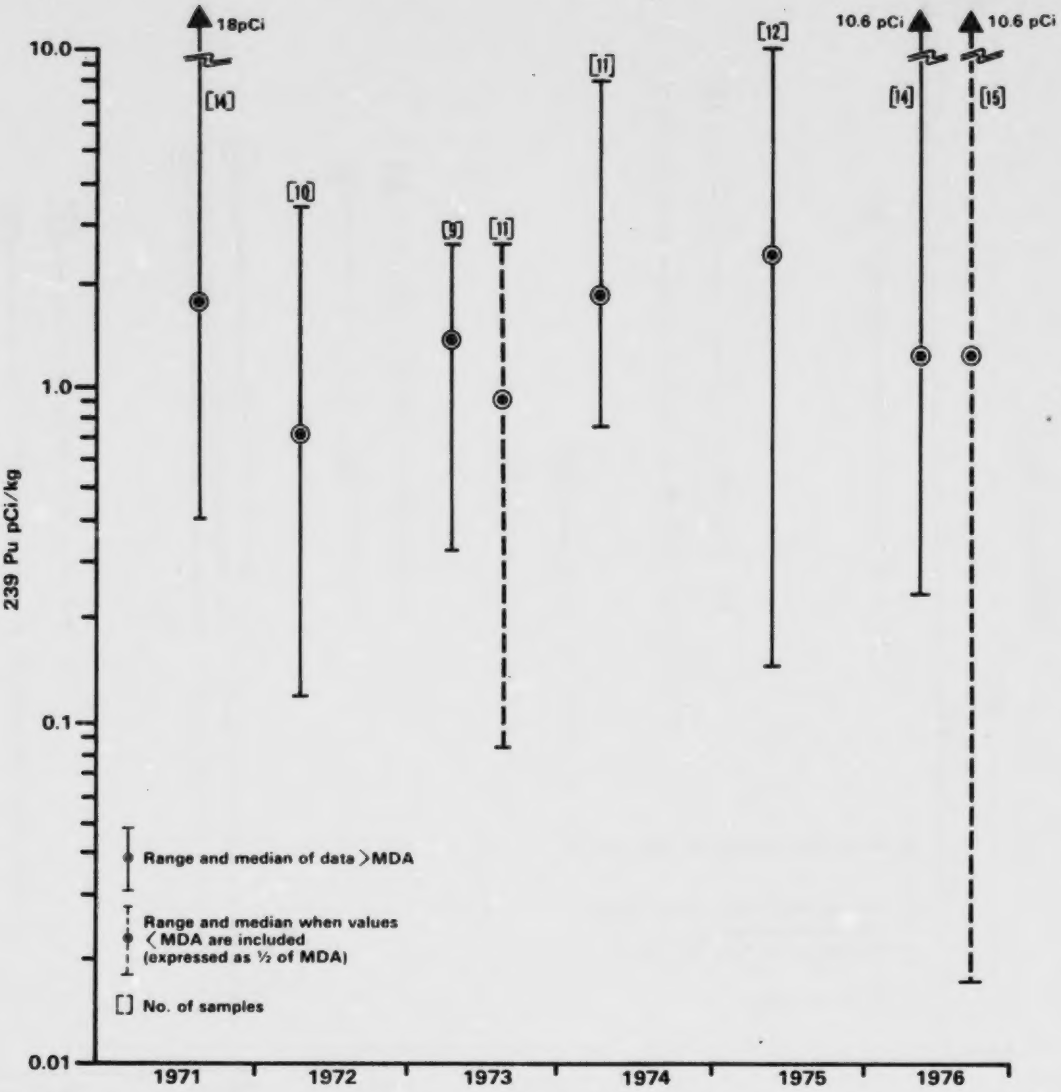

Figure 4. Ranges and median values of ^{239}Pu in fresh lung tissues from Nevada Test Site cattle 1971-1976.

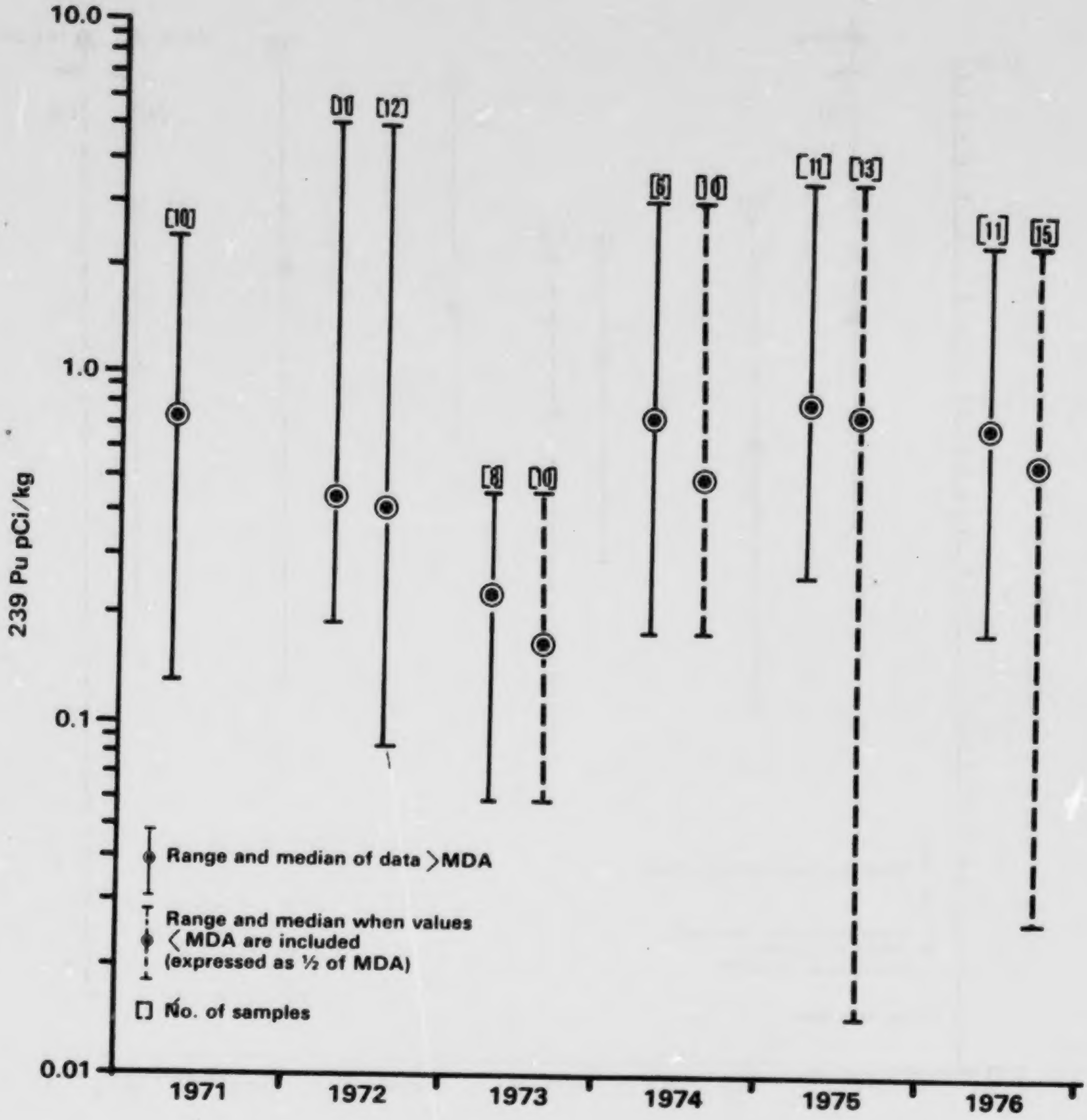

Figure 5. Ranges and median values of ^{239}Pu in fresh liver tissues from Nevada Test Site beef cattle 1971-1976.

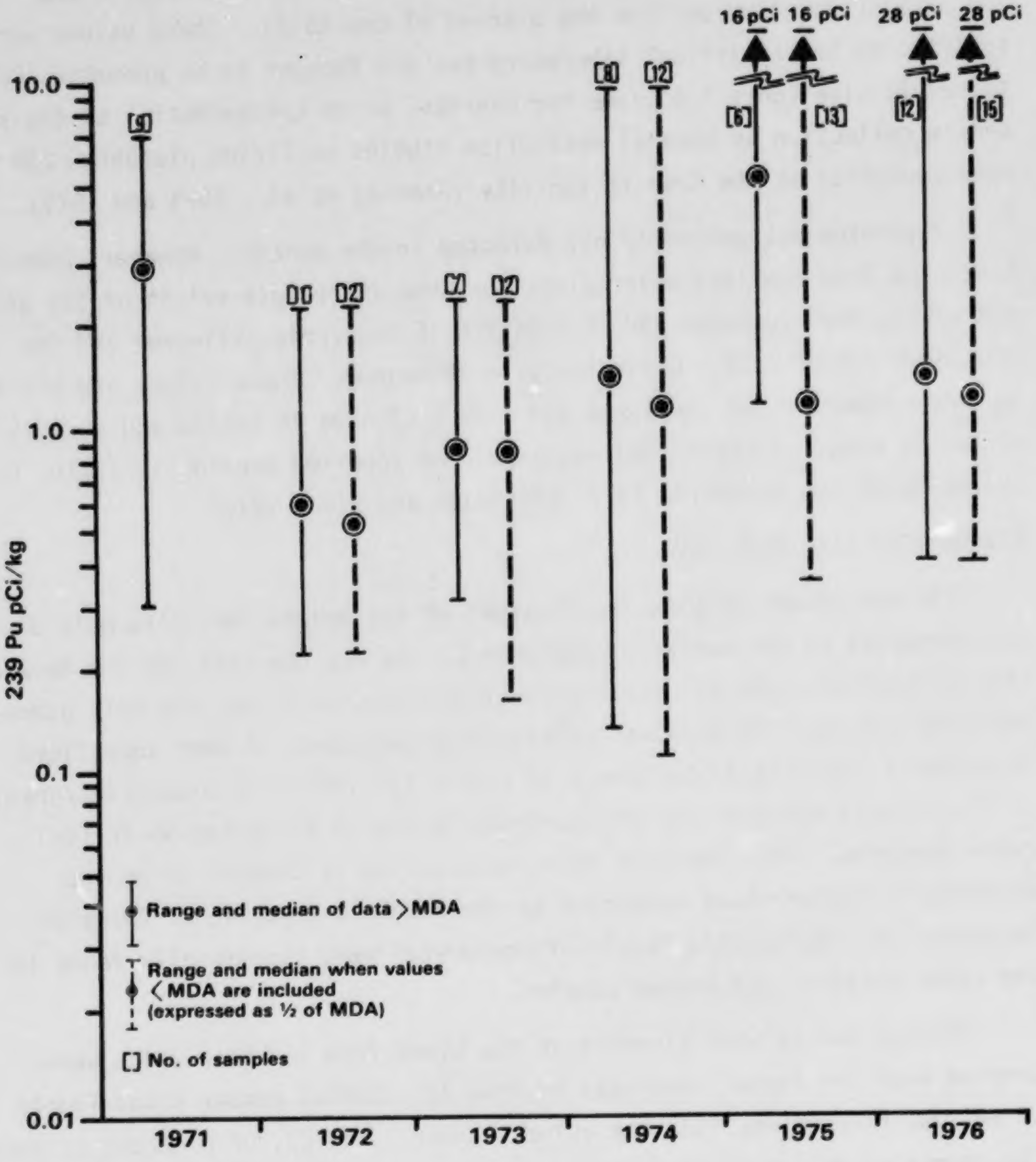

Figure 6. Ranges and median values of ^{239}Pu in fresh femur tissues from Nevada Test Site beef cattle 1971-1976.

Several incongruous plutonium-238 values were reported (i.e. 40 picocuries/kilogram in tracheobronchial lymph nodes from cow number 6 and 708 picocuries/kilogram from the ovaries of cow A5-2). These values were verified by the analytical laboratory but are thought to be anomalies related to sample size (only 7.8 grams for ovaries) or to contamination of the sample during collection as several metabolism studies utilizing plutonium-238 have been conducted at the Area 15 facility (Stanley et al., 1974 and 1975).

Plutonium was generally not detected in the gonads. However, composited testicles from the 1976 male calves for Area 18 (sample weight of 380 grams) had values for plutonium-238 of 0.25 ± 0.15 picocuries/kilogram and for plutonium-239 of 2.27 ± 0.49 picocuries/kilogram. These values are similar to those reported for the lungs and livers of Area 18 cattle and surpass that of the muscles. Similar findings have been reported previously (Smith 1977a, 1977b; Smith and Bernhardt 1977; and Smith and Black 1975).

NEVADA TEST SITE MULE DEER

The analytical results from tissues of the Nevada Test Site mule deer are presented in the tables of appendix D. As was the case for the Nevada Test Site cattle, the naturally occurring potassium-40 was the only gamma-emitting radionuclide that was consistently detected. A deer sacrificed in December had detectable levels of iodine-131 (44 ± 2.2 picocuries/gram) in its thyroid and 260 ± 62 picocuries/kilogram of zirconium-95 in its rumen contents. The source of this radionuclide is thought to be the atmospheric nuclear test conducted by the People's Republic of China on September 25. Detectable levels of cesium-137 were occasionally found in the rumen contents and kidney samples.

Tritium levels were elevated in the blood from two deer which were sampled near the tunnel complexes of Area 12. Animal number 6 had levels of 600,000 picocuries/liter and animal number 1 had 23,000 picocuries/liter. The source of this tritium is thought to be the waters that drain from E tunnel into Haines pond as elevated tritium levels from these waters (4.2×10^6 picocuries/liter) have been reported previously (Smith et al., 1977b).

The average strontium-90 level in bone ash from these deer was

2.1 picocuries/gram which is similar to levels of 2.6 and 2.3 picocuries/gram of ash reported in 1974 and 1975 (see figure 3).

The median values of plutonium levels in tissues from Nevada Test Site deer are shown in table 6. These levels are similar to those reported in 1975. Plutonium-239 was detected in the testicles from one of two male deer sampled. This level of 1.6 ± 0.76 picocuries/kilogram is slightly higher than levels reported in other soft tissues.

TABLE 6. MEDIAN VALUES OF PLUTONIUM CONCENTRATIONS IN 1976 NEVADA TEST SITE DEER TISSUES (pCi/kg wet wt.)

Tissue	^{238}Pu	^{239}Pu
Lungs	<0.035	0.26 ± 0.11
Muscle	<0.07	<0.28
Liver	<0.04	0.14 ± 0.13
Rumen Contents	0.65	5.5 ± 1.1
Bone	1 ± 0.7	1.2 ± 1.1

DESERT BIGHORN SHEEP

Desert bighorn sheep were the third large ruminant species sampled during 1976. These animals were sampled through the cooperation of licensed hunters. Analytical data from selected tissues are listed in the tables of appendix E. Muscles were not sampled as the meat was retained by the participating hunters.

The only gamma-emitting radionuclides reported, other than the naturally occurring potassium-40, were cesium-137 and zirconium-95. Cesium-137 was occasionally reported in the kidney and rumen contents with one value of 14 ± 4.6 picocuries/kilogram wet weight reported in the liver from animal number 12. Zirconium-95 was frequently reported in the ingesta of the animals and may be related to the atmospheric test conducted in September by the People's Republic of China.

Tritium levels in the aqueous portion of the kidney tissues ranged from <277 to 560 picocuries/liter with a median value of 307 picocuries/liter.

The average strontium-90 concentration in bone (hock) was 2.9 picocuries/gram of ash which is similar to that reported in the years immediately prior to 1975 (see figure 3).

The median values of plutonium levels in selected tissue samples from desert bighorn sheep are shown in table 7. Detectable levels of plutonium-238 were seldom found in all tissues sampled, whereas plutonium-239 was usually detected in the rumen contents (12 out of 18) and in about 25 percent of the lung, liver, and bone samples.

Food habit analyses of the ingesta were performed to provide management data for the Nevada Department of Fish and Game and are discussed in another section of this report. Few definite trends are apparent, when diet, location, and activities are compared, other than that in most years the strontium-90 levels are usually higher in the desert bighorn sheep than in deer or cattle. This may be related to increased age of the sampled population or to the fact that the higher elevations where the desert bighorn sheep reside receive more precipitation.

TABLE 7. MEDIAN VALUES OF PLUTONIUM CONCENTRATIONS IN 1976 DESERT BIGHORN SHEEP TISSUES (pCi/kg wet wt.)

Tissue	^{238}Pu	^{239}Pu
Lungs	<0.73	1
Liver	<0.68	<0.68
Bone	<0.58	<0.71
Rumen Contents	<0.28	0.74

NEVADA TEST SITE HORSES

During 1976, two feral horses died after being struck by vehicles. Only bone and muscle samples were collected from these animals as they were in advanced stages of decomposition when found. The analytical data from these tissues are presented in appendix F. The muscle tissues from these animals did not contain detectable levels of tritium or plutonium. Cesium-137 (27 ± 11 picocuries/kilogram) was detected in the muscle for animal number 1. Strontium-90 levels in the bones were 9 ± 1.1 and 8.7 ± 1.2 picocuries/gram of ash, respectively. Plutonium-239 was detected in the bones of both animals, but was higher in the aged animal; i.e., 9.9 ± 1.5 picocuries/kilogram as compared to 0.87 ± 0.49 picocuries/kilogram which was reported for the 3-year-old animal.

NEVADA TEST SITE COYOTE

An immature female coyote was collected in Area 18 and selected tissue samples submitted for analysis. The data are presented in appendix G. The only gamma-emitting radionuclides detected in the tissues of this animal were potassium-40 and cesium-137. The cesium-137 level for all internal tissues was approximately 50 picocuries/kilogram while the skin contained 210 ± 20 picocuries/kilogram. The tritium concentration in the aqueous portion of the muscle tissue was 4,600 picocuries/liter.

The amount of strontium-90 in the femur was 1.6 ± 0.7 picocuries/gram of ash. Plutonium was either nondetectable or slightly above the minimum detectable limits in all tissue except the skin, which showed a burden of 16 ± 8.3 picocuries/kilogram of plutonium-239, and the stomach contents with 13 ± 1.3 picocuries/kilogram.

NEVADA TEST SITE RABBITS

Area 18 Rabbits

Selected tissues from seven Area 18 jackrabbits were collected in May and submitted for analysis. These data are tabulated in the tables of appendix H.

Concentrations of gamma-emitting radionuclides (naturally occuring potassium-40 and cesium-137), tritium, and strontium detected in the tissues of these animals were of similar magnitude to those found in the beef cattle which also graze this area. Gamma analysis of the skin from rabbit number 5 indicated the presence of americium-241. Radiochemical analysis of this sample revealed a level of 64 ± 12 picocuries/kilogram of americium-241.

The median values of plutonium in selected tissues are shown in table 8. Plutonium levels in the Area 15 rabbit bones were also similar to those reported for the beef cattle. Plutonium levels in the other tissues sampled were several times higher than that reported for similar tissue collected from the beef cattle in April.

TABLE 8. MEDIAN VALUES OF PLUTONIUM CONCENTRATIONS IN 1976 NEVADA TEST SITE RABBIT TISSUES (pCi/kg wet wt.)

Tissue	AREA 18 MAY		AREA 15 MARCH		AREA 15 SEP	
	^{238}Pu	^{239}Pu	^{238}Pu	^{239}Pu	^{238}Pu	^{239}Pu
Muscles	<0.65	0.93	<0.33	<0.33	<0.16	0.31
Internal Organs	<0.13	1.6	1.2	3.7	1.7	7.7
G. I. Tract	1.3	11	1.5	36	13.5	310
Skin	10	70	19.3	290	2.6	33
Bone	<0.4	<0.35	0.47	1.7	1.4	1.8

The median plutonium-239 value in muscle from the rabbits was 0.93 picocuries/kilogram compared to <0.08 for the cattle, and the median value of rabbit internal organs was 1.6 picocuries/kilogram compared to 0.4 picocuries/kilogram for cattle livers. The plutonium-239 levels were also higher in rabbit ingesta as reflected by a median value of 11 picocuries/kilogram for the gastrointestinal tract as compared to 0.87 picocuries/kilogram for rumen contents from cattle.

Area 15 Rabbits

Rabbits (predominantly cottontails) residing on the Area 15 experimental farm were collected in March and September. Data from these samples are presented in the tables of appendixes I and J.

Levels of cesium-137 in the tissues collected at both times were similar to those found in the Area 18 rabbits and in other Nevada Test Site species. However, tritium levels in the muscle samples collected in September were nearly 10 times greater than those collected in March, the median values being 5,300 picocuries/liter versus 680 picocuries/liter. Positive zirconium-95 levels were reported only in September (three gastrointestinal tract samples).

Median values shown in table 8 reveal that the tissues from Area 15 rabbits contained higher plutonium-239 values than did the Area 18 rabbits. The plutonium-239 levels in the gastrointestinal tract, internal organs, and skin samples from the Area 15 rabbits showed considerable variability between the two sampling periods while the levels for muscle and bone were quite consistent.

A detectable level of plutonium-239, 3.8 ± 2.1 picocuries/kilogram, was found in the testicles of one of two male rabbits sampled. Again this level is higher than those reported for muscle tissue and is similar to those reported for bone.

NEVADA TEST SITE CHUKAR AND QUAIL

Three chukar and two quail were collected from the fields of the Area 15 farm in September. The feathers, viscera, bone, and muscle from each species of bird were composited in order to provide adequate volume for analysis. The data from these birds are presented in appendix K.

The strontium, tritium, and gamma-emitting radionuclide levels reported from these samples were of the same magnitude as those reported for similar tissues from other Nevada Test Site species. As with the Area 15 rabbits, those samples subjected to soil contamination (feather and viscera) frequently had plutonium-239 levels in the 100- to 1,000-picocuries/kilogram range. These values indicate that Area 15 is more highly contaminated than Area 18.

NEVADA TEST SITE WATERS

Several natural springs that serve as a source of water for wildlife were sampled during 1976. Also sampled were algae growing in these springs. These waters and algae were analyzed for gamma-emitting radionuclides and tritium and the analytical results are presented in table 9. The taxonomic identification of the algae and chemical content of the waters will be published as a separate report.

No gamma-emitting radionuclides were found in any of the spring waters and tritium levels were either nondetectable or at ambient levels. Three of four algae samples contained detectable levels of cesium-137 and the sample from Captain Jack Spring (2,500 picocuries/kilogram) was about 10 times higher than the algae sampled at the other springs. However, this might be partially due to differences in the moisture content of the respective samples.

TABLE 9. TRITIUM AND GAMMA ANALYSIS OF SPRING WATER AND ALGAE, NEVADA TEST SITE, 1976

	WATER ANALYSIS			ALGAE ANALYSIS*		
Spring Name	Date	Gamma Analysis	^{3}H (pCi/l)	Date	K (g/kg)	^{137}Cs (pCi/kg)
Cane	05/04	GSN	<230	06/16	4.4 ± 0.36	350 ± 8.3
Captain Jack	05/04	GSN	<230	06/16	14 ± 4.8	2,500 ± 72
Green	05/04	GSN	<230			
Oak	05/04	GSN	<230	06/16	1.9 ± 0.27	170 ± 19
Tippipah	05/04	GSN	270 ± 260			
Topopah	05/04	GSN	910 ± 240			
Tub	05/04	GSN	<230			
White Rock	05/04	GSN	<230	06/16	GSN	GSN

*Wet weight
GSN = Gamma spectrum negligible

NECROPSY AND HISTOPATHOLOGICAL EXAMINATIONS

All sacrificed animals were necropsied and selected tissue and lesion samples were collected for histopathological evaluation. The gross and microscopic pathology observed are summarized in appendix L. Also included in this appendix are the results of hematology examination when performed. Some of these latter values may be depressed as most of the blood samples were collected after death.

As in previous years, sarcocysts were detected in both cattle and deer heart or muscle tissues. This is a ubiquitous parasite of both warm- and cold-blooded vertebrates and is considered to have little clinical significance (Merck and Company 1973).

The incidence of other clinical conditions encountered, actinobacillosis (cow number 2 and cow number 9) and liver abscesses (animal A5-3), was felt to be within normal limits for the populations examined. Occasionally observed histologic findings; e.g., hemosiderosis of the spleen, capsular melanosis of the adrenal, and hyperplasia of the tracheobronchial lymph nodes, were felt to be within normal levels by the examining pathologist. No pathology, gross or necroscopic, was observed that could be directly attributed to ionizing radiation.

HYPOTHETICAL DOSE ESTIMATES

Although meat from animals living on the Nevada Test Site is not available for consumption by the general public, the dose to a standard man based on postulated consumption of the meat can be calculated. The dose estimates are not presented as an implication of potential doses, but rather to place the reported radionuclide concentrations in perspective. The dose estimates are based on the techniques and parameters of the International Commission for Radiation Protection (1959, 1968) and Dillman (1969). The estimates were from the maximum observed concentrations of the radionuclides in edible tissues of the cattle and deer sampled (summarized in table 10), and the postulated consumption of 500 grams (about 1 pound) of the meat each day for a year.

The International Commission for Radiation Protection (1959) and the U.S. Energy Research and Development Administration (1975) present different dose criteria for various parts of the body, based on estimates of relative radiosensitivity. The National Council on Radiation Protection and Measurements (1971) recognizes this philosophy, but recommends simplifying the guides for the general population, and uses the minimum guide (0.5 rem per year to the whole body for an individual in an uncontrolled area) for all body organs. The National Council on Radiation Protection and Measurements emphasizes that this is a simplifying administrative decision, rather than a reduction of the guides based on new technical information.

Table 10 presents a summary of the maximum observed concentrations in edible tissues of the animals. The indicated error terms are the two-sigma counting error. The total analytical errors or uncertainties (two-sigma)

TABLE 10. SUMMARY OF PEAK RADIONUCLIDE CONCENTRATIONS IN EDIBLE TISSUE FROM NEVADA TEST SITE CATTLE AND MULE DEER, 1976 (pCi/kg wet wt.)

Nuclide	AREA 18 CATTLE April 1976				AREA 18 CATTLE October 1976				NTS MULE DEER 1976			
	Muscle	Liver	Thyroid (pCi/g)	Blood (pCi/l)	Muscle	Liver	Thyroid (pCi/g)	Blood (pCi/l)	Muscle	Liver	Thyroid (pCi/g)	Blood (nCi/l)
^{131}I	<MDA	<MDA	<MDA	NA	<MDA	<MDA	150 ± 1	NA	<MDA	<MDA	44 ± 2.2	NA
^{238}Pu	1.2 ± 0.19	0.96 ± 0.28	NA	NA	0.18 ± 0.09	0.28 ± 0.14	NA	NA	0.28	<0.08	NA	NA
^{239}Pu	0.41 ± 0.17	1.1 ± 0.38	NA	NA	0.34 ± 0.15	2.3 ± 0.68	NA	NA	0.56 ± 0.14	0.4 ± 0.13	NA	NA
^{137}Cs	39 ± 12	13 ± 4.2	NA	NA	<MDA	18 ± 11	NA	NA	<MDA	<MDA	NA	NA
^{3}H	NA	NA	NA	<260	NA	NA	NA	<310	NA	NA	NA	600 ± 2.3

<MDA = less than minimum detectable activity
NA = not analyzed

for the plutonium and uranium results are estimated to be about 200 femtocuries/kilogram for results of several hundred femtocuries/kilogram, or several times the indicated counting errors. Thus, differences between values, when the values are under several hundred femtocuries/kilogram, have limited statistical significance given the total analytical uncertainties of the results.

Table 11 indicates postulated doses based on the data for maximum concentrations for the various nuclides summarized in table 10. The column on the right indicates the respective fraction of the guide of 500 millirems/year for the various postulated doses. The doses from plutonium, uranium, and to a lesser extent, cesium-137, are not delivered in 1 year. For practical purposes, however, the integrated doses for a 1-year ingestion period are related to the yearly guide. Postulated doses for iodine-131 have not been calculated since its presence is a short-term transient resulting from foreign testing and would not be present in the indicated concentration over a period of a year.

The highest postulated dose, 11 millirems, is for tritium as a result of ingesting meat from a mule deer. All of the other postulated doses are less than 1 millirem and are similar to those estimated for 1975 (Smith et al., 1978). The observed tritium concentrations probably resulted from the mule deer ingesting contaminated waters that drain from the tunnels in Area 12.

The maximum postulated dose to man from any single radionuclide is about 2 percent of the guide of 500 millirems/year, based on tritium from mule deer muscle and liver. The maximum values for bovines are less than 0.1 percent, which are about the same values as for 1975 (Smith et al., 1978).

FOOD HABIT ANALYSIS

Evidence indicates that the selection of foods by desert bighorn sheep (*Ovis canadensis nelsoni*) can be attributed primarily to plant availability and secondarily to the habitat being occupied. Over 450 plant species are utilized by bighorn sheep as reported by Brown et al. (1977) and Browning (1971). These data also indicate that grasses are generally preferred, with more than 70 species represented. Other important families, in order of

TABLE 11. POSTULATED DOSE TO MAN FOLLOWING INGESTION OF SELECTED TISSUES FOR 1 YEAR, 1976

Nuclide	Human Organ for Which Dose was Calculated	Animal Tissue Containing Maximum Concentration	pCi/kg of Tissue	Dose Factor mrem:pCi/da (1-yr ingestion)*	Dose (mrem)	Percent 0.5 rem
$^{3}H^{\dagger}$	Body water	NTS Mule Deer, August, blood	600,000 ± 2,300	3.6×10^{-5}	11	2
^{137}Cs	Whole body tissue	Area 18 Cattle, April, muscle	39 ± 12	0.022	0.43	0.09
^{238}Pu	Bone	Area 18 Cattle, April, muscle	1.2 ± 0.19	0.27	0.16	0.03
^{239}Pu	Bone	Area 18 Cattle, April, muscle	1.1 ± 0.38	0.32	0.18	0.04

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*The doses from uranium and plutonium-238 and -239, and to a lesser extent cesium-137, are not delivered within the 1-year ingestion period, but, for simplification, the doses have been related to the guide for 1 year. The doses for uranium and plutonium are actually for a 50-year period, but it should be recognized that the doses are resulting from ingestion over a 1-year period.

†The tritium concentration was for blood. It is assumed the muscle concentration (water plus organic) per kilogram was equal to the blood concentration per liter.

preferred species, have been shown to be in the sunflower (*Compositae*), the pea (*Leguminosae*), and the rose (*Rosaceae*) families. Appendix M lists the plant species ingested by the desert bighorn sheep during 1976.

In addition to the tissue samples collected from the bighorn sheep for radionuclide analysis, rumen ingesta from 28 sheep were collected and analyzed for their botanical composition (see appendix N). All of these animals were rams collected in the months of November and December during the 1976 annual hunting season. Thirteen of these rams were collected from the Las Vegas, Pintwater, and Sheep Ranges that are all located within the boundaries of the Desert National Wildlife Range. An additional 13 animals were collected from 6 different mountain ranges located in the extreme southern portion of Nevada, and the remaining 2 were collected from Lone Mountain located in central Nevada.

The Desert National Wildlife Range, located approximately 64 kilometers north of Las Vegas, contains about 910,543 hectares of a highly diversified flora. The flora of this and the surrounding area was identified and classified by Bradley (1964). He reported that this area is made up of four different vegetative types: the desert shrub type represented by the four lower Sonoran plant communities--desert riparian, creosote bush, blackbrush, and saltbush; a woodland type represented by the three upper Sonoran plant communities--juniper-pinyon, riparian, and cliff; a coniferous forest type represented by the fir-pine communities; and a small alpine tundra type represented by a pseudo-alpine community.

The Desert National Wildlife Range provides the largest continuous block of bighorn habitat in the state and undoubtedly supports the largest single desert bighorn sheep population in the United States.

Table 12 shows the plant species and the percentage composition of forage eaten by the 13 animals harvested on the Desert National Wildlife Range. Grasses consumed by these animals made up 61.4 percent of the total. Of this total more than two-thirds consisted of Indian ricegrass (*Oryzopsis hymenoides*) and squirrel tail (*Sitanion hystrix*) contributing 23.8 percent and 20.9 percent, respectively. Shrubs were represented by 20 species contributing 28.8 percent of the total diet. Preferred shrub species included cliff rose (*Cowania mexicana*) with 4.3 percent and little-leaved mountain

TABLE 12. THE PLANT SPECIES AND THE PERCENT COMPOSITION OF FORAGE EATEN BY DESERT BIGHORN SHEEP HARVESTED FROM THE DESERT NATIONAL WILDLIFE RANGE DURING NOVEMBER AND DECEMBER 1976

Species	Average Composition Percent	Frequency of Occurrence Percent
Oryzopsis hymenoides	23.8	100
Sitanion hystrix	20.9	85
Unidentified grasses	8.2	92
Poa sp.	1.7	23
Festuca sp.	1.7	8
Muhlenbergia sp.	1.6	8
Stipa speciosa	1.3	31
Muhlenbergia porteri	1.3	8
Hilaria jamesii	0.7	15
Bromus tectorum	0.2	8
Total Percent Grasses	61.4	100
Unidentified forbs	5.4	100
Eriogonum sp.	1.7	92
Sphaeralcea ambigua	1.6	8
Chaenactis sp.	0.6	31
Astragalus sp.	0.3	8
Euphorbia sp.	0.2	8
Total Percent Forbs	9.8	100
Unidentified shrubs	7.8	100
Cowania mexicana	4.3	23
Cercocarpus intricatus	3.2	38
Atriplex confertifolia	2.6	38
Ceanothus greggii	1.7	23
Eurotia lanata	1.2	8
Artemisia tridentata	1.1	23
Ceanothus sp.	1.1	8
Atriplex canescens	1.0	15
Atriplex hymenelytra	0.9	8
Encelia sp.	0.7	8
Encelia farinosa	0.6	23
Ambrosia dumosa	0.6	8
Purshia glandulosa	0.5	8
Chrysothamnus sp.	0.4	8
Ephedra nevadensis	0.4	15
Atriplex sp.	0.3	15
Pinus monophylla	0.2	8
Amelanchier alnifolia	0.1	8
Coleogyne ramosissima	0.1	15
Juniperus osteosperma	T	8
Total Percent Shrubs	28.8	100

T = trace, less than 0.1 percent

mahogany (*Cercocarpus intricatus*) contributing 3.2 percent of the total diet. Forbs made up the remaining 9.8 percent of the diet with desert buckwheat (*Eriogonum* sp.) and desert mallow (*Sphaeralcea ambigua*) contributing 1.7 percent and 1.6 percent of the diet.

As previously stated, 13 animals were harvested from 6 different mountain ranges. These ranges, Eldorado, Mormon, Black, Muddy, Meadow Valley, and Highland, are all located in the extreme southern portion of Nevada. These mountain ranges are similar floristically each having well-developed creosote (*Larrea divaricata*), blackbrush (*Coleogyne ramosissima*), and desert riparian plant communities. In addition to these communities, the Mormon Range has a fairly extensive pinyon-juniper plant community. Additional descriptive habitat data are available for each of these mountain ranges (Brown et al., 1978).

Table 13 shows the plant species and percentage composition of the forage eaten by the 13 animals harvested on the 6 southern Nevada mountain ranges. The preferred forage was grasses which made up 50 percent of the total diet. Similar to findings for sheep harvested on the Desert National Wildlife Range, the two preferred species were squirrel tail and Indian ricegrass, each contributing 23.4 percent and 14.2 percent of the total diet, respectively. Shrubs contributed 32.6 percent of the diet with little-leaved mountain mahogany, burro bush (*Ambrosia dumosa*), and four-winged saltbush (*Atriplex canescens*) contributing a total of 13.1 percent of the total diet. Forbs were represented by nine genera making up 17.4 percent of their diet. Preferred forbs included desert spurge (*Euphorbia* sp.), desert buckwheat, desert mallow, and desert pincushion (*Chaenactis* sp.) contributing 2.8 percent, 2.5 percent, 1.8 percent, and 1.2 percent of the total diet, respectively.

The Lone Mountain region provides some of the roughest and most inaccessible bighorn sheep habitat in Nevada. It is located about 24 kilometers west of Tonopah and provides about 77 square kilometers of bighorn sheep habitat.

The three plant communities commonly found in the Lone Mountain region include the saltbush (*Atriplex* sp.), the big sagebrush (*Artemisia tridentata*), and the woodland pinyon-juniper. All three are extensive and well-developed.

TABLE 13. THE PLANT SPECIES AND THE PERCENT COMPOSITION OF FORAGE EATEN BY DESERT BIGHORN SHEEP HARVESTED FROM SOUTHERN NEVADA DURING NOVEMBER AND DECEMBER 1976

Species	Average Composition Percent	Frequency of Occurrence Percent
Sitanion hystrix	23.4	100
Oryzopsis hymenoides	14.2	92
Unidentified grasses	9.5	100
Poa sp.	1.2	23
Hilaria jamesii	0.8	15
Stipa speciosa	0.7	23
Festuca sp.	0.2	8
Total Percent Grasses	50.0	100
Unidentified forbs	7.4	100
Euphorbia sp.	2.8	54
Eriogonum sp.	2.5	85
Sphaeralcea ambigua	1.8	46
Chaenactis sp.	1.2	46
Amsinckia sp.	0.6	8
Stanleya pinnata	0.5	8
Astragalus sp.	0.2	15
Penstemon sp.	0.2	8
Erodium cicutarium	0.2	8
Total Percent Forbs	17.4	100
Unidentified shrubs	8.6	92
Cercocarpus intricatus	5.9	23
Ambrosia dumosa	4.3	23
Atriplex canescens	2.9	46
Encelia farinosa	2.0	8
Ephedra nevadensis	1.9	31
Eurotia lanata	1.5	23
Ceanothus sp.	1.1	8
Encelia sp.	1.0	15
Ceanothus greggii	0.9	8
Garrya flavescens	0.5	8
Chrysothamnus nauseosus	0.4	8
Coleogyne ramosissima	0.4	15
Cowania mexicana	0.4	15
Chrysothamnus sp.	0.4	8
Chrysothamnus viscidiflorus	0.1	8
Ephedra viridia	0.1	8
Atriplex confertifolia	0.1	8
Encelia frutescens	0.1	8
Pinus monophylla	T	8
Total Percent Shrubs	32.6	100

T = trace, less than 0.1 percent

Table 14 shows the plant species and the percentage composition of the forage eaten by the two sheep harvested on Lone Mountain. Similar to the forage preferred by the sheep harvested from the two other regions, grasses were dominant. More than 50 percent of their diet consisted of three grass species. Squirrel tail, galleta (*Hilaria jamesii*), and Indian ricegrass were preferred contributing 35.0 percent, 10.5 percent, and 8.5 percent of the total diet, respectively. Shrubs made up 30.5 percent of the total diet with big sagebrush and antelope-brush (*Purshia glandulosa*) preferred. Forbs contributed 5.5 percent of the total diet with desert spurge contributing 1.5 percent of the total diet.

TABLE 14. THE PLANT SPECIES AND THE PERCENT COMPOSITION OF FORAGE EATEN BY DESERT BIGHORN SHEEP HARVESTED FROM CENTRAL NEVADA DURING NOVEMBER 1976

Species	Average Composition Percent	Frequency of Occurrence Percent
Sitanion hystrix	35.0	100
Hilaria jamesii	10.5	100
Oryzopsis hymenoides	8.5	50
Unidentified grasses	7.0	100
Bromus tectorum	3.0	50
Total Percent Grasses	64.0	100
Unidentified forbs	2.5	100
Euphorbia sp.	1.5	50
Sphaeralcea sp.	1.0	50
Chaenactis sp.	0.5	50
Total Percent Forbs	5.5	100
Artemisia tridentata	11.5	100
Purshia glandulosa	10.5	100
Unidentified shrubs	4.0	50
Ceanothus sp.	3.5	50
Atriplex confertifolia	1.0	50
Total Percent Shrubs	30.5	100

OTHER ACTIVITIES

BEEF HERD

During 1976, the Animal Investigation Program's beef herd continued to subsist on the natural vegetation of Area 18. Semiannual roundups of the herd were conducted in April and October. At each roundup, all captured animals were examined, weighed, and sprayed for ectoparasites. The 1976 calves were branded, vaccinated, identified with tattoos and ear tags, and when indicated were castrated and dehorned. Twenty-nine calves were weaned. One hundred and eight animals were accounted for during the October roundup.

DEER MIGRATION STUDY

As described previously (Smith et al., 1978), during the summer months, a sizable mule deer herd resides in the mountainous regions of the Nevada Test Site. The location of this herd during the winter months is of interest to both the U.S. Energy Research and Development Administration and the Nevada Department of Fish and Game as these animals could be harvested by the general public if they eventually reach unrestricted lands. A study designed to determine the migration patterns of this herd through tracking of individual deer outfitted with collars containing miniature radio transmitters was begun in 1975 and continued through 1976.

Between July 1 and October 31, 14 deer were captured either by chemical restraint of free-ranging animals (Smith et al., 1978) or by trapping (Giles 1978). Thirteen of these deer were outfitted with radiotransmitting collars, ear tags, and reflective identification numbers suspended from a collar. One deer that was too large for the transmitter collar was released with visual markings only.

An additional three animals were captured but were euthanized because of injuries suffered during the capture process. There were no losses due to the immobilizing drugs. Two of the marked animals were killed by mountain lions, one about 4 hours after it was released and the other 13 months later.

Of the 13 radio transmitters placed in the field, 6 were still working 12 months later. Two of the radios that failed were recovered and examined. It was found that the wires between the battery and the transmitter had parted, probably from repeated flexing of the collar assembly during the normal movements of the deer. The manufacturer eliminated the long leads and this problem should not recur during 1977.

The movements of the 13 deer were monitored weekly via either ground or aerial vehicles using a receiver and directional antenna. The movements of these deer are shown in figure 7. Three deer did not leave the general area of their original capture. However, they were able to descend from the 2,200-meter elevation to another meadow at 2,000 meters by moving approximately 1.5 kilometers. Three animals migrated off the Nevada Test Site at the western boundary in the Beatty Wash area of Timber Mountain. The remainder of the animals moved south to Timber Mountain or 40-Mile Canyon or the western edge of Shoshone Mountain in Area 30.

There appeared to be no set pattern to the migration as individual deer left the Echo Peak area from October 7 through January 31, 1977, and returned from late April 1977 through late June 1977. The winter of 1976 was quite mild and probably a more definite pattern would be observed in years of higher snowfall and lower temperatures.

Individual deer dispersed over a wide area within their winter ranges and extensive movements occurred between the weekly sightings. This contrasts markedly with the summer pattern in which deer seldom moved a kilometer between weekly sightings.

INVESTIGATIONS, SURVEYS, AND OTHER STUDIES

During 1976, there were no livestock damage claims requiring investigation.

The Animal Investigation Program's rumen-fistulated steers were used in a study to determine plutonium uptake by animals grazing a contaminated range. Details and data from this study, conducted under the auspices of the Nevada

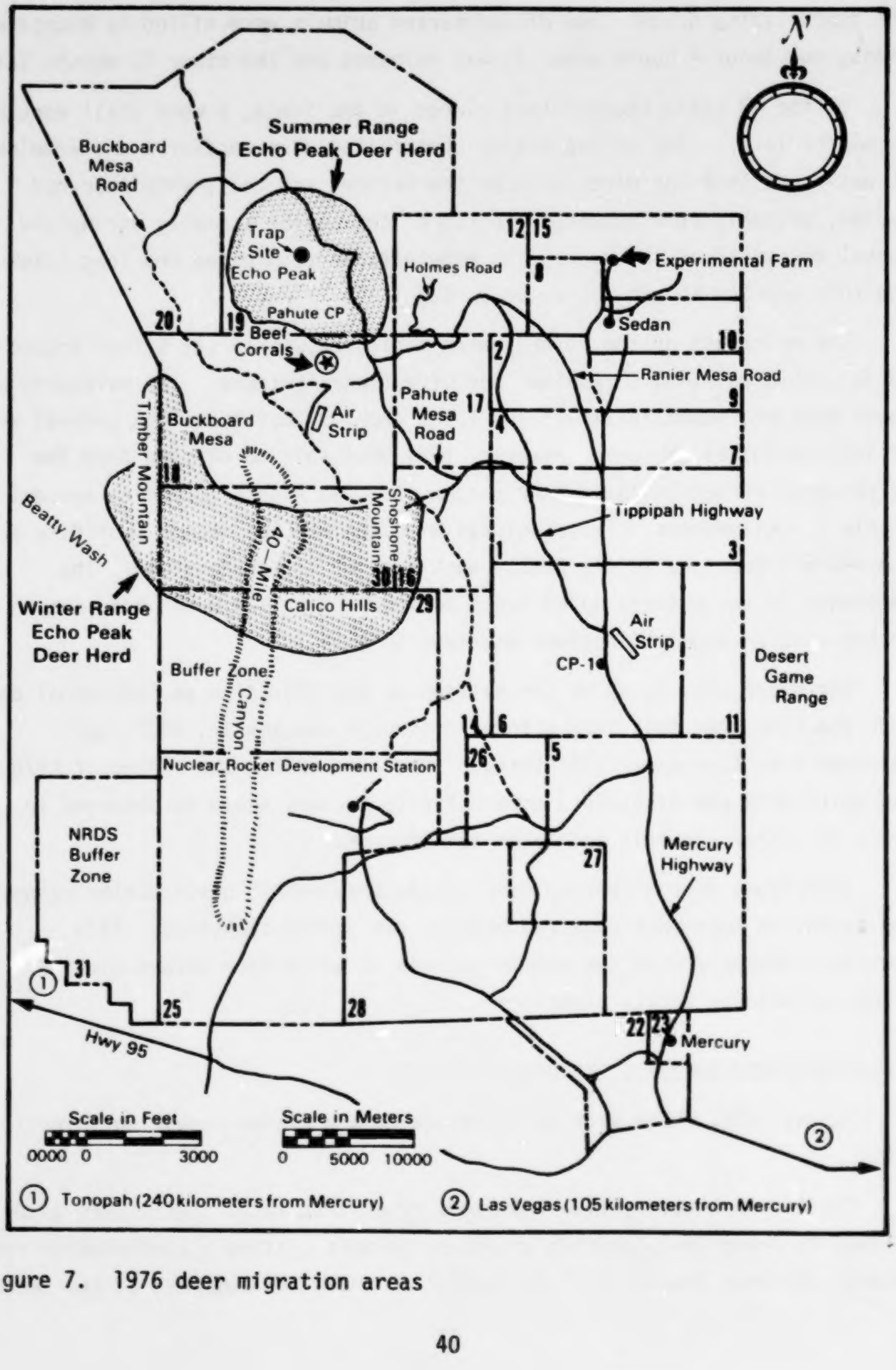
N
Summer Range
Echo Peak Deer Herd
Buckboard
Mesa
Road
Trap
Site
Echo Peak
Pahute CP
Beef
Corrals
Experimental Farm
12
15
8
Holmes Road
Sedan
10
20
19
2
Ranier Mesa Road
Air
Strip
Pahute
Mesa
Road
17
9
4
Buckboard
Mesa
7
Timber Mountain
18
Beatty Wash
40—Mile
Canyon
Shoshone
Mountain
Tippipah Highway
1
3
30
16
Winter Range
Echo Peak
Deer Herd
Calico Hills
29
Air
Strip
Buffer Zone
CP-1
Desert
Game
Range
14
6
11
26
5
Nuclear Rocket Development Station
NRDS
Buffer
Zone
Mercury
Highway
27
①
31
25
28
22
23
Mercury
Hwy 95
Scale in Feet
0000 0 3000
Scale in Meters
0 5000 10000
②
① Tonopah (240 kilometers from Mercury)
② Las Vegas (105 kilometers from Mercury)

Figure 7. 1976 deer migration areas

Applied Ecology Group, are presented elsewhere (Smith 1974, 1977b, and 1978).

Maintenance continued on the natural springs of the Nevada Test Site that were renovated in 1975 as described by Smith et al. (1978). This work consisted of removal of debris and repair of broken pipes.

During August, 27 mourning doves (*Zenoida macroura*) were captured at the Area 15 farm and leg bands were applied. Hunter returns of these bands should give an indication of the migratory patterns of this bird from the Nevada Test Site. Knowledge gained as to proper baiting and trapping techniques should allow an expanded trapping program during the fall of 1977.

PUBLIC INFORMATION

The off-site public information program continued by direct contact with ranchers, by newspaper articles and television interviews, by public displays featuring a rumen-fistulated steer, and by presentations to groups touring the Environmental Monitoring and Support Laboratory-Las Vegas or the Nevada Test Site facilities. During 1976, the objectives and findings of the Animal Investigation Program were described to over 400 Nevada Test Site visitors in 30 different tour groups. A rumen-fistulated steer served as a feature attraction at an educational exhibit displayed at the annual Earth Day open house at the Environmental Monitoring and Researh Laboratory-Las Vegas in April and at the Pahrump Fall Fair held in September at Pahrump, Nevada. An estimated 5,000 people visited the exhibit at these locations and received information on the Animal Investigation Program's objectives and findings.

An interview with an Associated Press reporter resulted in many news releases throughout the country. Clippings were received from newspapers as far away as Florida. The Animal Investigation Program's activities were also featured in a newspaper article in the Las Vegas Review Journal and in a television news report filmed by KATU-TV of Portland, Oregon.

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Type of Analysis	Analytical Equipment	Counting Period (min)	Analytical Procedures	Sample Size	Minimum Detectable Activities (pCi/total sample)*
Gamma Spectroscopy	Lithium-drifted germanium detectors calibrated at approximately 0.5 keV per channel input to 4096 channels resident in the core of the PDP 11/20 computer.	~1,200	Radionuclide concentrations quantitated from gamma spectrum by PDP 11/20 computer using a least squares technique.	200-ml aluminum cans	For: ^{54}Mn, ^{60}Co, ^{95}Zn, ^{103}Ru, ^{124}Sb, ^{132}Te, ^{131}I, ^{134}I, ^{137}Cs, ^{140}Ba - 7 pCi For: ^{125}Sb, ^{141}Ce - 30 pCi For: ^{65}Zn, ^{106}Ru, ^{144}Ce - 20 pCi For: ^{181}W - 85 pCi For: ^{241}Am - 35 pCi For: ^{22}Na - 4 pCi
$^{89-90}$Sr	Low-background thin-window, gas-flow proportional counter with a 5.7-cm diameter window (80 μg/cm^2).	50	Chemical separation by ion exchange. Separated sample counted successively; activity calculated by simultaneous equations.	2 g of ash	For: ^{89}Sr - 5 pCi ^{90}Sr - 2 pCi
^{3}H	Automatic liquid scintillation counter with output printer.	200	Sample prepared by distillation.	5 ml	~0.2 pCi/ml H_2O
$^{238-239}$Pu ^{234}, ^{235}, ^{238}U	Alpha spectrometer with silicon surface barrier detectors operated in vacuum chambers.	400-1,400	Ash sample is digested with acid, purified by solvent extraction and/or ion exchange, electroplated on stainless steel planchet, and counted by alpha spectrometer.	100 g - 1 kg wet weight 1 - 10 g ash	For all isotopes - ~0.02 pCi

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*The minimum detectable activities in terms of total activity per sample for standard geometries and counting times are based on a combination of a number of technical experiments and operational experience. By means of experimentation, the minimum detectable activities have been defined as that activity which produced a ± 100 percent deviation at the 95 percent confidence level. These values are approximations and are applicable to ideal conditions and simple complexes of nuclides. Complex spectra or spectra showing naturally occurring radionuclides can raise the minimum detectable activities considerably. The detection limit for each sample is defined as that radioactivity which equals the two-sigma counting error.

TABLE B-1. PLUTONIUM CONCENTRATIONS IN LUNGS, BEEF CATTLE, AREA 18, NTS, 1976*

April 1976					October 1976				
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio	Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
1	13.7 ± 4.4 410 ± 130	137 ± 18 4,060 ± 550	3	9.9	7	8.4 ± 5.1 430 ± 260	209 ± 30 10,600 ± 1,500	5.1	24.7
Fetus 1	<20 <120	80 ± 32 500 ± 200	0.6	>4	Dupl. 7‡	10.8 ± 7.7 420 ± 300	29.7 ± 13.3 1,150 ± 510	3.9	2.7
2	13.8 ± 6.2 370 ± 170	40 ± 11.2 1,080 ± 300	2.7	2.9	8	5.2 ± 3.9 250 ± 180	44.5 ± 11 2,110 ± 520	4.8	8.4
3	18.2 ± 7.7 720 ± 310	69.1 ± 17.5 2,740 ± 700	4	3.8	9	9.5 ± 4.5 470 ± 220	132 ± 18 6,610 ± 910	5	14.1
4	<3.8 <170	25 ± 10.6 1,200 ± 490	4.6	>6	10	<0.65 <30	<0.65 <30	4.6	---
5	8.4 ± 5.3 320 ± 200	24.9 ± 9.9 950 ± 380	3.8	3	11	<2.3 <110	2.9 ± 2.6 140 ± 130	4.9	Λ1
6	3.6 ± 2 160 ± 90	18.3 ± 5.3 840 ± 240	4.6	5.3	12	5 ± 2.2 230 ± 100	11.6 ± 3.4 530 ± 160	4.6	2.3
Dupl. 6‡	12.5 ± 8.2 230 ± 150	32.6 ± 14.1 610 ± 260	1.97	2.7					
Median	13.1 325	36.5 1,005	3.4	>4.6	Median	5.2 250	29.7 1,150	4.8	5.5
Range	3.6-<20 <120-720	18.3-137 500-4,060	0.6-4.6	2.7-9.9	Range	<0.65-10.8 <30-470	<0.65-209 <30-10,600	3.9-5.1	>1-24.7

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight
‡Duplicate blind sample

TABLE B-2. PLUTONIUM CONCENTRATIONS IN TRACHEOBRONCHIAL LYMPH NODES, BEEF CATTLE, AREA 18, NTS, 1976*

April 1976					October 1976				
Animal No.	^{238}Pu (pCi/g Ash) (pCi/kg†)	^{239}Pu (pCi/g Ash) (pCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio	Animal No.	^{238}Pu (pCi/g Ash) (pCi/kg†)	^{239}Pu (pCi/g Ash) (pCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
1	0.17 ± 0.08 4.61 ± 1.97	1.03 ± 0.2 27 ± 5.3	2.6	5.9	7	<0.03 <0.33	<0.03 <0.33	1.3	---
2	<0.02 <0.82	<0.02 <0.82	4.1	---	8	<0.008 <0.36	<0.008 <0.36	4.6	---
3	<0.09 <5	0.11 ± 0.06 6.11 ± 3.33	5.6	>1	9	<0.1 <0.63	<0.1 <0.63	0.6	---
4	<0.05 <0.61	<0.05 <0.61	1.2	---	10	<0.05 <0.33	<0.1 <0.66	3.8	---
5	0.01 0.54	<0.01 <0.54	3.8	---	11	<0.1 <0.64	<0.1 <0.64	0.6	---
6	4.1 ± 0.7 40.4 ± 6.9	0.7 ± 0.2 6.9 ± 1.97	1	0.2	12	<0.002 <0.29	<0.002 <0.29	3.8	---
Dupl. 6‡	5.1 ± 1 50.2 ± 9.8	0.7 ± 0.25 6.9 ± 2.43	1	0.1					
Median	<0.09 <5	0.07 6.9	2.6	>0.6	Median	<0.04 <0.35	<0.2 <0.50	2.6	
Range	<0.01-5.1 <0.54-50.2	<0.01-1.03 <0.54-27	1-5.6	0.1-5.9	Range	<0.1 <0.64	<0.1 <0.64	0.6-4.6	

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight
‡Duplicate blind sample

TABLE B-3. PLUTONIUM CONCENTRATIONS IN MUSCLES, BEEF CATTLE, AREA 18, NTS, 1976*

April 1976					October 1976				
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{238}Pu:^{239}Pu Ratio	Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{238}Pu:^{239}Pu Ratio
1	35.7 ± 5.5 1,200 ± 190	5.4 ± 1.9 180 ± 60	3.4	0.15	7	<0.7 <40	6.8 ± 3 340 ± 150	5	----
Dupl. 1‡	35.7 ± 5.3 1,200 ± 180	4.4 ± 1.6 150 ± 50	3.4	0.12	Dupl. 7‡	7.2 ± 3.6 180 ± 90	22 ± 5.6 550 ± 140	2.5	----
Fetus 1	<1.4 <40	<1.4 <40	2.7	----	8	<0.3 <10	<0.3 <10	5.2	----
2	<1.20 <60	<1.20 <60	5.1	----	9	<1.3 <60	<1.3 <60	4.7	----
3	<1.20 <50	<1.20 <50	3.8	----	10	<0.36 <20	<0.36 <20	5.5	----
4	<0.8 <30	<0.8 <30	4.3	----	11	<0.45 <20	<0.45 <20	5.4	----
5	<1.5 <80	<1.5 <80	5	----	Dupl. 11‡	<0.63 <30	<0.63 <30	5.4	----
6	<0.7 <30	8 ± 3.4 410 ± 170	5.1		12	<0.97 <40	<1.95 <80	4.2	----
Dupl. 6‡	<1.6 <60	8.1 ± 5.1 300 ± 190	3.7						
Median	<1.4 <60	<1.5 <80	3.8		Median	<1.3 <3.5	<0.96 <0.45	5.1	
Range	<0.7-35.7 <30-1,200	<0.8-8.1 <30-410	2.7-5.1		Range	<0.3-7.2 <10-180	<0.3-22 <10-550	2.5-5.5	

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight
‡Duplicate blind sample

TABLE B-4. PLUTONIUM CONCENTRATIONS IN LIVERS, BEEF CATTLE, AREA 18, NTS, 1976*

April 1976					October 1976				
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio	Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
1	4.9 ± 2.8 110 ± 60	17.8 ± 5.3 400 ± 120	2.2	3.6	7	<0.96 <50	3.7 ± 2.6 210 ± 150	5.6	>3.8
Fetus 1	<3.3 <60	<3.3 <60	1.9	---	8	2.3 ± 2.1 90 ± 80	20.2 ± 6.2 770 ± 240	3.8	8.5
2	23.2 ± 6.9 960 ± 280	19.6 ± 6.3 820 ± 260	4.2	0.9	Dupl. 8‡	6.5 ± 5.8 220 ± 200	68.2 ± 19.9 2,330 ± 680	3.4	10.6
3	<0.98 <50	<0.98 <50	4.8	---	9	2.3 ± 2 100 ± 90	35.8 ± 7.8 1,660 ± 360	4.6	16
4	3.7 ± 3 180 ± 140	23.8 ± 7.9 1,140 ± 380	4.8	6.3	10	<0.73 <50	<0.73 <50	7.4	---
5	<0.22 <20	2.5 ± 1.5 200 ± 120	8.1	>11	11	<1.8 <110	<3.6 <220	6	---
6	NA NA	6.8 ± 3.6 490 ± 250	7.2	---	12	4 ± 2.4 250 ± 150	33.6 ± 7.3 2,080 ± 450	6.2	8
					Dupl. 12‡	4.6 ± 2.8 280 ± 140	34.4 ± 6.6 2,130 ± 410	6.2	7
Median	3.5 <85	6.8 400	4.8	2.3	Median	2.3 <105	32.3 1,215	5.8	8.3
Range	<0.22-23.2 <20-960	<0.98-23.8 <50-1,140	1.9- 8.1	0.9- >11	Range	<0.73-6.5 <50-280	<0.73-68.2 <50-2,330	3.4- 7.4	>3.8- 10.6

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight
‡Duplicate blind sample
NA = Not analyzed

TABLE B-5. PLUTONIUM CONCENTRATIONS IN GONADS, BEEF CATTLE, AREA 18, NTS, 1976*

April 1976					October 1976				
Animal No.	Sex	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	Animal No.	Sex	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)
1	F	Lost	Lost		7	Steer	NC	NC	
2	F	<20 <630	<20 <630	3.1	8	F	<150 <970	<150 <970	0.6
3	Steer	NC	NC		9	F	<167 <2,270	<167 <2,270	1.4
4	Steer	NC	NC		10	M	<2.6 <120	<2.6 <120	4.6
5	Steer	NC	NC		11	M	<3.6 <90	<3.6 <90	2.6
6	Steer	NC	NC		12	M	<3.1 <80	<3.1 <80	2.4
					Composite 0.5 year-old males		6.4 ± 4 250 ± 150	59 ± 13 2,270 ± 490	3.8
					Median		<5 <185	<31.3 <545	2.5
					Range		<2.6-<167 <80-<2,270	<2.6-<167 <80-2,270	0.6-4.6

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight
NC = Not collected

TABLE B-6. PLUTONIUM CONCENTRATIONS IN RUMEN CONTENTS, BEEF CATTLE, AREA 18, NTS, 1976*

April 1976					October 1976				
Animal No.	^{238}Pu (pCi/g Ash) (pCi/kg†)	^{239}Pu (pCi/g Ash) (pCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio	Animal No.	^{238}Pu (pCi/g Ash) (pCi/kg†)	^{239}Pu (pCi/g Ash) (pCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
1	<0.002 <0.05	0.054 ± 0.02 1.4 ± 0.55	2.6	>27	7	0.023 ± 0.0065 0.69 ± 0.19	0.17 ± 0.021 5.2 ± 0.63	3	7.5
2	NA NA	0.029 ± 0.012 0.87 ± 0.36	3	---	8	0.011 ± 0.0045 0.43 ± 0.18	0.10 ± 0.016 4 ± 0.63	4	9.30
Dupl. 2‡	0.02 ± 0.006 0.51 ± 0.18	0.029 ± 0.008 0.86 ± 0.24	3	1.69	9	0.048 ± 0.008 1.5 ± 0.24	0.20 ± 0.014 5.9 ± 0.56	3	3.93
3	0.019 ± 0.008 0.54 ± 0.23	0.075 ± 0.020 2.2 ± 0.57	2.9	4.07	10	0.036 ± 0.007 1.3 ± 0.25	0.095 ± 0.012 3.4 ± 0.44	3.6	2.61
4	<0.001 <0.03	0.014 ± 0.009 0.3 ± 0.2	2.2	>14	11	0.047 ± 0.012 1.1 ± 0.29	0.26 ± 0.034 6.2 ± 0.79	2.4	5.64
5	0.075 ± 0.012 1.4 ± 0.22	0.40 ± 0.04 7.2 ± 0.77	1.8	5.14	12	0.011 ± 0.004 0.28 ± 0.10	0.12 ± 0.015 3.2 ± 0.4	2.6	11.43
6	<0.003 <0.09	0.013 ± 0.008 0.35 ± 0.21	2.7	>4.3					
Median	0.011 0.30	0.029 0.87	2.7	> 4.7	Median	0.030 0.90	0.15 4.6	3	6.6
Range	<0.001-0.075 <0.03-1.4	0.013-0.40 0.3-7.2	1.8-3	1.69->27	Range	0.011-0.048 0.28-1.5	0.095-0.26 3.2-6.2	2.4-4	2.6-11.4

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight
NA = Not analyzed
‡Duplicate blind sample

TABLE B-7. PLUTONIUM CONCENTRATIONS IN RETICULUM SEDIMENTS, BEEF CATTLE, AREA 18, NTS, 1976*

April 1976					October 1976				
Animal No.	^{238}Pu (pCi/g Ash) (pCi/kg†)	^{239}Pu (pCi/g Ash) (pCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio	Animal No.	^{238}Pu (pCi/g Ash) (pCi/kg†)	^{239}Pu (pCi/g Ash) (pCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
1	0.024 ± 0.008 4.1 ± 1.4	0.21 ± 0.028 34 ± 4.7	16.7	8.4	7	0.0045 ± 0.0041 4 ± 3.7	0.17 ± 0.031 150 ± 28	89	37.0
2	0.069 ± 0.019 3.3 ± 0.91	0.056 ± 0.015 2.7 ± 0.76	4.9	0.8	8	0.031 ± 0.014 25 ± 12	0.18 ± 0.04 150 ± 33	81.5	5.8
3	0.016 ± 0.007 9.6 ± 4.3	0.063 ± 0.015 37 ± 9	58	3.8	9	0.25 ± 0.035 200 ± 28	0.88 ± 0.098 700 ± 78	79.4	3.6
4	0.048 ± 0.031 15 ± 9.5	0.17 ± 0.068 51 ± 21	30.9	3.4	10	2.1 ± 0.16 1,100 ± 80	3 ± 0.22 1,600 ± 120	54.5	1.5
5	0.092 ± 0.027 3.7 ± 1.1	1.9 ± 0.24 77 ± 9.6	4	21	11	0.030 ± 0.016 22 ± 12	0.14 ± 0.038 100 ± 27	72.7	4.5
6	0.008 ± 0.005 3.2 ± 2.2	0.021 ± 0.009 8.5 ± 3.5	40.7	2.6	12	<0.058 <19	<0.058 <19	33.3	---
Median	0.036 3.9	0.12 36	23.8	3.6	Median	<0.045 24	0.18 150	76.1	5.2
Range	0.008-0.092 3.2-15	0.021-1.9 2.7-77	4- 58	0.8- 21	Range	0.045-2.1 4-1,100	<0.058-3 <19-1,600	33.3- 89	1.5- 37

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight

TABLE B-8. PLUTONIUM AND STRONTIUM CONCENTRATIONS IN FEMURS, BEEF CATTLE, AREA 18, NTS, APRIL 1976*

Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	^{89}Sr (pCi/g Ash) (pCi/kg†)	^{90}Sr (pCi/g Ash) (pCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
1	<1.5 <370	4.1 ± 2.2 980 ± 530	3 ± 2.4 710 ± 580	1.9 ± 0.63 460 ± 150	24	>2.7
Fetus-1	<2.1 <200	8.6 ± 4.3 830 ± 420	<0.1 <980	<0.65 <63	9.7	>4.1
2	<2.9 <630	26 ± 5.5 5,800 ± 1,200	4 ± 2.8 890 ± 610	2.3 ± 0.73 500 ± 160	22	>9
3	<4 <950	4.6 ± 3.3 1,100 ± 800	<5.4 <1,300	2 ± 0.71 480 ± 170	24	>1.1
4	<2.3 <610	8.1 ± 2.9 2,200 ± 780	<1.4 <380	4.8 ± 0.7 1,300 ± 190	27	>3.5
5	<1.6 <360	2.1 ± 1.7 490 ± 390	<1.3 <310	3.3 ± 0.65 760 ± 150	23	>1.3
6	3.1 ± 3.1 630 ± 620	7.5 ± 3.8 1,500 ± 760	<1.6 <320	3.1 ± 0.70 620 ± 140	20	2.38
Dupl. 6‡	1.6 ± 1.5 440 ± 410	3.4 ± 2 930 ± 530	<1.4 <390	4.8 ± 0.7 1,300 ± 190	27	2.1
Median	<2.2 <525	6.1 1,040	<1.5 <550	2.7 560	23.5	>3.1
Range	<1.5-4 <200-<950	2.1-26 490-5,800	<0.1-<5.4 <310-<1,300	<0.65-4.8 <63-1,300	9.7-27	>1.1->9

*All analyses by Eberline Instrument Corporation.
†Wet weight
‡Duplicate blind sample

TABLE B-9. PLUTONIUM AND STRONTIUM CONCENTRATIONS IN FEMURS, BEEF CATTLE, AREA 18, NTS, OCTOBER 1976[*]

Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg[†])	^{239}Pu (fCi/g Ash) (fCi/kg[†])	^{89}Sr (pCi/g Ash) (pCi/kg[†])	^{90}Sr (pCi/g Ash) (pCi/kg[†])	Ash (%)	^{239}Pu:^{238}Pu Ratio
7	<3.1 <0.92	<3.7 <1,100	<1.7 <520	2.8 ± 0.77 850 ± 230	30	<1.2
Dupl. 7[‡]	1.7 ± 1.2 510 ± 370	2.8 ± 1.6 840 ± 470	<1.6 <470	2.8 ± 0.73 830 ± 220	30	1.6
8	2.1 ± 1.7 650 ± 530	<3.7 <1,100	<18 <5,600	3.2 ± 0.84 1,000 ± 260	31	<1.8
9	22 ± 12 6,100 ± 3,300	100 ± 27 28,000 ± 7,700	<3.1 <860	11 ± 1.4 3,100 ± 400	28	4.6
10	<1.3 <310	1.3 ± 1.2 310 ± 300	<2 <470	3.8 ± 0.88 900 ± 210	24	>1
11	1.9 ± 1.5 480 ± 380	1.4 ± 1.4 360 ± 340	<1.7 <430	3.3 ± 0.8 830 ± 200	25	0.75
12	3.1 ± 1.9 690 ± 410	19 ± 4.2 4,100 ± 920	<1.7 <370	2.4 ± 0.77 530 ± 170	22	5.94
Median	2.1 510	<3.7 <1,100	<1.7 <470	3.2 850	28	<1.2
Range	<1.3-22 <0.92-6,100	1.3-100 310-28,000	<1.6-<18 <370-<5,600	2.4-11 530-3,100	22-31	0.75-5.9

[*] All analyses by EMSL-LV.
[†] Wet weight
[‡] Duplicate blind sample

TABLE B-10. GAMMA-EMITTING RADIONUCLIDES AND TRITIUM CONCENTRATIONS IN SELECTED TISSUES, BEEF CATTLE, AREA 18, NTS, 1976

	MUSCLE	LUNGS	LIVER	KIDNEY	RUMEN CONTENTS	THYROID	BLOOD
Animal No.	K (g/kg*) ^{137}Cs (pCi/kg*)	K (g/kg*)	K (g/kg*) ^{137}Cs (pCi/kg*)	K (g/kg*) ^{137}Cs (pCi/kg*)	K (g/kg*) ^{137}Cs (pCi/kg*)	^{131}I (pCi/g*)	^{3}H (pCi/l)
1	3.5 ± 0.28 39 ± 12	11 ± 1.3	9.2 ± 0.82 <MDA	2.4 ± 0.23 21 ± 4.9	1.1 ± 0.35 <MDA	GSN	<260
Fetus 1	11 ± 1 <MDA	1.6 ± 0.19	3.5 ± 0.32 21 ± 14	3.6 ± 0.27 32 ± 12	SNC	GSN	SNC
2	8.9 ± 0.3 <MDA	3.5 ± 0.68	3.4 ± 0.28 <MDA	8.6 ± 0.73 <MDA	0.79 ± 0.44 <MDA	GSN	<260
3	8.2 ± 0.67 <MDA	3 ± 0.86	2.2 ± 0.23 <MDA	6.7 ± 0.54 <MDA	2.3 ± 0.91 <MDA	GSN	<260
4	15 ± 1.4 <MDA	3.5 ± 0.34	3.3 ± 0.29 <MDA	6.2 ± 0.54 <MDA	2.5 ± 0.97 <MDA	GSN	<260
5	3.5 ± 0.39 19 ± 12	1.7 ± 1.5	3.5 ± 0.29 13 ± 4.2	2.8 ± 0.21 20 ± 4.3	0.82 ± 0.37 26 ± 25	GSN	<260
6	8.6 ± 0.69 <MDA	4.1 ± 0.47	7.6 ± 0.63 <MDA	2.7 ± 0.22 41 ± 4.7	1.2 ± 0.42 <MDA	GSN	<260
7	7.8 ± 0.6 <MDA	2.9 ± 0.22	3 ± 0.27 <MDA	3.3 ± 0.54 21 ± 10	2 ± 0.29 27 ± 15	21 ± 0.27	<310
8	15 ± 1.2 <MDA	12 ± 1.1	3.3 ± 0.29 <MDA	2.2 ± 0.26 <MDA	1.4 ± 0.19 33 ± 25	71 ± 0.88	<310
9	3.8 ± 0.32 <MDA	9.7 ± 0.92	2.5 ± 2.2 <MDA	7.4 ± 0.64 <MDA	1.1 ± 0.44 <MDA	37 ± 0.64	<310
10	8.3 ± 0.57 <MDA	11 ± 1	7.8 ± 0.66 <MDA	7.2 ± 0.64 <MDA	GSN	120 ± 2.1	<310
11	4 ± 0.25 <MDA	2.9 ± 0.22	8.1 ± 0.66 <MDA	2.2 ± 0.24 17 ± 11	1.4 ± 0.87 <MDA	62 ± 1.5	<310
12	8.9 ± 0.69 <MDA	17 ± 1.5	3.4 ± 0.31 18 ± 11	7.7 ± 0.57 <MDA	3.1 ± 0.9 <MDA	150 ± 1	<310
Median	8.3 <MDA	3.5	3.5 <MDA	3.6 <MDA	1.4	21	<285
Range	3.5-15 <MDA-39	1.6-17	2.2-9.2 <MDA-21	2.2-8.6 <MDA-41	0.79-3.1 <MDA-33	<MDA-150	<260-<310

*Wet weight

<MDA = less than minimum detectable activity.

GSN = gamma spectrum negligible

SNC = sample not collected

TABLE C-1. PLUTONIUM CONCENTRATIONS IN LUNGS, OTHER CATTLE, NTS, 1976*

Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
A5-1	<3.1 <30	<6.9 <70	0.9	---
A5-2	6.7 ± 3.7 90 ± 50	37 ± 8.9 480 ± 120	1.7	5.3
A5-3	<2 <30	31 ± 8.5 480 ± 130	1.6	---
Median	<3.1 <30	31 480	1.6	
Range	<2-6.7 <30-90	<6.9-37 <70-480	0.9- 1.7	
Cow 286	13 ± 5.9 130 ± 60	103 ± 16 1,000 ± 160	1	

*All plutonium analyses by Eberline Instrument Corporation.

†Wet weight

TABLE C-2. PLUTONIUM CONCENTRATIONS IN TRACHEOBRONCHIAL LYMPH NODES, OTHER CATTLE, NTS, 1976*

Animal No.	^{238}Pu (pCi/g Ash) (pCi/kg†)	^{239}Pu (pCi/g Ash) (pCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
A5-1	<0.09 <1.6	<0.09 <1.6	1.7	---
A5-2	<0.03 <0.49	<0.09 <1.5	1.6	---
A5-3	<0.08 <1.4	<0.17 <2.7	1.6	---
Median	<0.08 <1.4	<0.09 <1.6	1.6	
Range	<0.03-<0.09 <0.49-<1.6	<0.09-<0.17 <1.5-<2.7	1.6- 1.7	
Cow 286	NC	NC	NC	

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight
NC = Not collected

TABLE C-3. PLUTONIUM CONCENTRATIONS IN MUSCLES, OTHER CATTLE, NTS, 1976*

Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
A5-1	13 ± 6.2 230 ± 110	18.5 ± 7.3 330 ± 130	1.8	1.4
A5-2	<0.34 <10	<0.34 <10	4.1	---
A5-3	<0.39 <20	<0.39 <20	4.8	---
Median	<0.39 <20	<0.39 <20	4.1	
Range	<0.34-13 <10-230	<0.34-18.5 <10-330	1.8-4.8	
Cow 286	5.3 ± 4.9 110 ± 100	19 ± 9.4 410 ± 200	2.1	3.7

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight

TABLE C-4. PLUTONIUM CONCENTRATIONS IN LIVERS, OTHER CATTLE, NTS, 1976*

Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
A5-1	10.8 ± 5.8 150 ± 80	113 ± 22 1,570 ± 300	1.4	10.5
A5-2	6.7 ± 3.7 90 ± 50	37 ± 8.9 480 ± 120	1.3	5.3
A5-3	8.2 ± 4.7 190 ± 110	14.8 ± 6.5 340 ± 150	2.3	1.8
Median	8.2 150	37 340	1.4	5.3
Range	6.7-10.8 90-190	14.8-113 340-1,570	1.3-2.3	1.8-10.5
Cow 286	<4.6 <60	30.5 ± 14.4 430 ± 200	1.4	>6.6

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight

TABLE C-5. PLUTONIUM CONCENTRATIONS IN GONADS, OTHER CATTLE, NTS, 1976*

Animal No.	Sex	^{238}Pu (pCi/g Ash) (pCi/kg†)	^{239}Pu (pCi/g Ash) (pCi/kg†)	Ash (%)	^{239}Pu:^{238}Pu Ratio
A5-1	F	<0.11 <1.9	<0.11 <1.9	1.7	---
A5-2	F	46.5 ± 13.8 708 ± 211	<0.33 <5.08	1.5	<0.007
A5-3	Steer	NC	NC	---	---
Median					
Range		<0.11-46.5 <1.9-708	<0.11-<0.33 <1.9-<5.08	1.5-1.7	
Cow 286		NC	NC	---	---

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight
NC = Not collected

TABLE C-6. PLUTONIUM AND STRONTIUM CONCENTRATIONS IN FEMURS, OTHER CATTLE, NTS, 1976*

Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	^{89}Sr (pCi/g Ash) (pCi/kg†)	^{90}Sr (pCi/g Ash) (pCi/kg†)	Ash (%)
A5-1	<0.18 <50	<0.18 <50	<14 <3,800	3.3 ± 0.8 880 ± 200	25
A5-2	<0.07 <50	<0.91 <67	<10 <7,500	1.4 ± 0.5 1,100 ± 400	73
A5-3	<0.09 <20	<0.09 <20	<11 <2,100	1.6 ± 0.5 330 ± 120	18.9
Median	<0.09 <50	<0.09-<0.91 <20-<67	<11 <3,800	1.6 880	26
Range	<0.07-<0.18 <20-<50	<0.09-<0.91 <20-<67	<10-<14 <2,000-<7,500	1.4-3.3 330-1,100	18.9-73
Cow 286	<7.6 <2,400	<7.6 <2,400	<9.1 <2,900	1.1 ± 0.53 340-170	32

*All plutonium analyses by Eberline Instrument Corporation.
†Wet weight

TABLE C-7. GAMMA-EMITTING RADIONUCLIDES AND TRITIUM CONCENTRATIONS IN SELECTED TISSUES, OTHER CATTLE, NTS, 1976*

	KIDNEY	MUSCLE	LIVER	LUNG	BLOOD
Animal No.	K (g/kg*) ^{137}Cs (pCi/kg*)	K (g/kg*) ^{137}Cs (pCi/kg*)	K (g/kg*) ^{137}Cs (pCi/kg*)	K (g/kg*)	^{3}H (pCi/l)
A5-1	2.2 ± 0.36	8.4 ± 0.60 <MDA	3.3 ± 0.22 <MDA	1.4 ± 0.72	270 ± 220
A5-2	1.7 ± 0.41	3.4 ± 0.19 <MDA	3.4 ± 0.28 <MDA	2.6 ± 0.38	<220
A5-3	1.9 ± 0.35	4 ± 2.2 32 ± 3.4	3.2 ± 0.2 21 ± 3	1.7 ± 0.39	250 ± 220
Median	1.9	4 <MDA	3.3 <MDA	1.7	250
Range	1.7-2.2	3.4-8.4 <MDA-32	3.2-3.4 <MDA-21	1.4-2.6	<220-270
Cow 286	1.7 ± 0.20 15 ± 3.9	2.9 ± 0.42	3.2 ± 0.63	2.1 ± 0.54	<220

*Wet weight

<MDA = less than minimum detectable activity.

TABLE D-1. PLUTONIUM CONCENTRATIONS IN SELECTED TISSUES, MULE DEER, NTS, 1976*

	LUNGS			MUSCLES			LIVER			RUMEN CONTENTS		
Animal	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)
1	<2.4 <30	14.6 ± 7.3 210 ± 100	1.4	<0.9 <20	13 ± 4.6 250 ± 90	2	<2.8 <40	11.1 ± 5.6 180 ± 90	1.6	41.7 ± 15.6 760 ± 280	308 ± 56 5,600 ± 1,010	1.8
2	4.7 ± 2.9 230 ± 140	9.7 ± 2.7 460 ± 130	4.8	SL SL	SL SL	3.8	<1.5 <80	2.6 ± 2.4 140 ± 130	5.4	1.6 ± 1.4 70 ± 60	17.4 ± 4.9 800 ± 230	4.6
3	<0.8 <40	2.3 ± 1.6 120 ± 80	5.3	<1.2 <30	3.5 ± 2.4 80 ± 50	2.2	<0.52 <20	<0.52 <20	2.9	230 ± 27 4,090 ± 480	1,720 ± 140 30,400 ± 2,600	1.8
4	<1.3 <20	10 ± 3.8 140 ± 50	1.4	15.2 ± 5.1 250 ± 80	34 ± 8.5 560 ± 140	1.7	<3.3 <40	3.3 ± 1.7 40 ± 20	1.2	20.6 ± 7.8 540 ± 200	248 ± 33 6,500 ± 880	2.6
5	<0.7 <20	12.6 ± 5 310 ± 120	2.4	<2.2 <70	4.4 ± 2.9 140 ± 100	3.3	<0.5 <10	13.2 ± 4.2 400 ± 130	3.1	34.5 ± 13.2 1,560 ± 600	115 ± 26 5,210 ± 1,190	4.5
6	<10 <220	30 ± 10 650 ± 220	2.2	<10 <280	<10 <280	2.8	SL SL	SL SL	SL	<10 <300	130 ± 30 3,800 ± 900	2.9
Median	<1.9 <35	11.3 260	2.3	2.2 <70	<10 <280	2.8	1.5 <40	11.1 140	2.9	27.6 650	189 5,405	2.9
Range	<0.7-<10 <20-230	2.3-30 120-650	1.4-5.3	<0.9-15.2 <20-<280	3.5-34 80-560	1.7-3.8	<0.5-<3.3 <10-<80	<0.52-13.2 <20-400	1.2-5.4	1.6-230 70-4,090	17.4-1,720 800-30,400	1.8-4.5

*All actinide analyses by Eberline Instrument Corporation.
†Wet weight
SL = Sample lost

TABLE D-2. PLUTONIUM CONCENTRATIONS IN GONADS, MULE DEER, NTS, 1976*

Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)
2	<0.6 <110	<2.3 <430	19
4	<0.8 <480	2.7 ± 1.3 1,600 ± 760	60

*All actinide analyses by Eberline Instrument Corporation.
†Wet weight

TABLE D-3. PLUTONIUM AND STRONTIUM CONCENTRATIONS IN BONES (HOCK), MULE DEER, NTS, 1976*

Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	^{89}Sr (pCi/g Ash) (pCi/kg†)	^{90}Sr (pCi/g Ash) (pCi/kg†)	Ash (%)
1	6.3 ± 4.7 2,000 ± 1,500	<1.8 <590	<14 <4,400	2.3 ± 0.53 750 ± 170	32
2	<7.8 <5,200	<9 <6,000	<6.9 <4,600	1.2 ± 0.73 790 ± 490	67
3	3 ± 2.1 1,000 ± 690	12 ± 3.6 3,900 ± 1,200	<4.5 <1,500	1.5 ± 0.7 480 ± 230	33
4	<0.84 <270	<0.53 <170	<4.4 <1,400	1.9 ± 0.53 600 ± 170	32
5	NA	NA	<4.3 <2,900	2.1 ± 0.79 1,400 ± 530	67
6	<2.9 <920	3.8 ± 3.4 1,200 ± 1,100	<3.8 <1,200	3.4 ± 0.78 1,100 ± 250	32
Median	3 1,000	3.8 1,200	<4.35 <3,650	2 770	32.5
Range	<0.84-<7.8 <270-2,000	<0.53-12 <170-<6,000	<3.8-<14 <1,200-<4,600	1.2-3.4 480-1,400	32-67

*All actinide analyses by EMSL-LV.
†Wet weight
NA = Not analyzed

TABLE D-4. GAMMA-EMITTING RADIONUCLIDES AND TRITIUM CONCENTRATIONS IN SELECTED TISSUES, MULE DEER, NTS, 1976*

	RUMEN CONTENTS	LIVER	LUNGS	KIDNEY	MUSCLE	THYROID	BLOOD
Animal No.	K (g/kg†) ^{137}Cs (pCi/kg†) ^{95}Zr (pCi/kg†)	K (g/kg†)	K (g/kg†)	K (g/kg†) ^{137}Cs (pCi/kg†)	K (g/kg†)	^{131}I (pCi/g†)	^{3}H (pCi/l)
1	3.2 ± 0.25 24 ± 3 <MDA	2.9 ± 0.67	<MDA	4 ± 0.57 43 ± 8.5	3.6 ± 0.64	<MDA	23,000 ± 510
2	1 ± 0.45 <MDA <MDA	2.3 ± 0.29	3.2 ± 0.3	0.56 ± 0.09 <MDA	4.2 ± 0.6	NC	530 ± 280
3	3.7 ± 0.43 <MDA <MDA	3.1 ± 1.1	1.4 ± 0.7	10 ± 0.8 <MDA	3.4 ± 0.37	NC	1,600 ± 290
4	2.3 ± 0.32 <MDA <MDA	2.6 ± 0.32	1 ± 0.46	2.5 ± 0.26 <MDA	3.3 ± 0.21	NC	16,000 ± 460
5	7.5 ± 1.2 <MDA <MDA	7.1 ± 6.1	3.1 ± 0.34	2.3 ± 0.57 <MDA	3.4 ± 0.27	NC	1,800 ± 300
6	5.5 ± 0.32 38 ± 16 260 ± 62	7.7 ± 0.57	8.8 ± 0.76	3.5 ± 0.31 44 ± 14	7.8 ± 0.59	44 ± 2.2	600,000 ± 2,300
Median	3.5 <MDA <MDA	3	2.3	3 <MDA	3.5	---	8,900
Range	1-7.5 <MDA-38 <MDA-260	2.3-7.7	GSN-8.8	0.56-10 <MDA-44	3.3-7.8		530-600,000

*All analyses by EMSL-LV.
†Wet weight
<MDA = less than minimum detectable activity.
NC = Not collected

TABLE E-1. PLUTONIUM CONCENTRATION IN SELECTED TISSUES, DESERT BIGHORN SHEEP, 1976*

	LUNGS			LIVER			RUMEN CONTENTS		
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg †)	^{239}Pu (fCi/g Ash) (fCi/kg †)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg †)	^{239}Pu (fCi/g Ash) (fCi/kg †)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg †)	^{239}Pu (fCi/g Ash) (fCi/kg †)	Ash (%)
1	<10 <250	<20 <500	2.5	<10 <170	<10 <170	1.7	<10 <240	<20 <480	2.4
2	<10 <430	30 ± 20 1,300 ± 900	4.4	<20 <700	<70 <700	3.5	<10 <250	120 ± 60 2,900 ± 1,400	2.5
3	<20 <1,100	90 ± 20 4,900 ± 1,100	5.4	<20 <440	<20 <440	2.2	<10 <240	90 ± 40 2,200 ± 1,000	2.4
4	<20 <1,000	20 ± 10 1,000 ± 500	5.1	30 ± 20 260 ± 170	70 ± 30 610 ± 260	0.9	<20 <440	<20 <440	2.2
5	<10 <410	<10 <410	4.1	NC NC	NC NC	NC	NC NC	NC NC	NC
6	<10 <740	<10 <740	7.4	<10 <380	<10 <380	3.8	<20 <520	160 ± 40 4,200 ± 1,000	2.6
7	<20 <790	<20 <790	4	<20 <500	<20 <500	2.5	<10 <270	30 ± 20 810 ± 540	2.7
8	<20 <690	30 ± 10 1,000 ± 300	3.4	<10 <160	<10 <160	1.6	<10 <200	<10 <200	2.1
9	<20 <1,300	<20 <1,300	6.5	<20 <780	<20 <780	3.9	<10 <220	30 ± 10 680 ± 220	2.3
10	20 <710	<20 <710	3.6	<20 <660	<20 <660	3.3	<20 <450	100 ± 30 2,200 ± 700	2.3

TABLE E-1. PLUTONIUM CONCENTRATIONS IN SELECTED TISSUES, DESERT BIGHORN SHEEP, 1976* (continued)

	LUNGS			LIVER			RUMEN CONTENTS		
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)
11	<20 <900	<20 <900	4.5	110 ± 20 1,300 ± 20	<20 <240	1.2	<10 <280	<10 <280	2.8
12	<20 <1,200	<20 <1,200	5.8	SL SL	SL SL	SL	<30 <800	<20 <540	2.7
13	<20 <1,900	40 ± 10 3,800 ± 1,000	9.6	<20 <1,700	<20 <1,700	8.5	<10 <300	<10 <300	2.9
14	<20 <1,200	<20 <1,200	6	<20 <900	<20 <900	4.5	<10 <250	30 ± 20 740 ± 500	2.5
15	<10 <600	<20 <1,200	6.1	<20 <1,400	20 ± 10 1,400 ± 700	7	<10 <200	50 ± 30 990 ± 590	2
16	<20 <530	<20 <530	2.7	<10 <390	<20 <780	3.9	<20 <500	30 ± 20 740 ± 500	2.5
17	<10 <140	<10 <140	1.4	<20 <1,500	<20 <1,500	7.6	<10 <620	70 ± 10 4,400 ± 600	6.2
18	<20 <1,200	<20 <1,200	5.8	30 ± 10 1,900 ± 600	410 ± 30 26,000 ± 200	6.4	<10 <250	80 ± 60 2,000 ± 1,500	2.7

TABLE E-1. PLUTONIUM CONCENTRATIONS IN SELECTED TISSUES, DESERT BIGHORN SHEEP, 1976* (continued)

	LUNGS			LIVER			RUMEN CONTENTS		
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	Ash (%)
19	<20 <630	<20 <630	3.1	<20 <1,400	20 ± 10 1,400 ± 70	6.9	40 ± 20 1,000 ± 500	520 ± 80 14,000 ± 2,000	2.7
20	<10 <170	<10 <170	1.7	<10 <80	50 ± 20 400 ± 160	0.8	NC NC	NC NC	NC
Median	<20 <725	<20 <1,000	4.45	<20 <680	<20 <680	3.7	<10 <275	30 740	2.5
Range	<10-<20 <140-<1,900	<10-90 <140-4,900	1.4- 9.6	<10-110 <80-1,900	<10-410 <160-26,000	0.8- 8.5	<10-40 <200-1,000	<10-520 <200-14,000	2- 6.2

*All analyses by Eberline Instrument Corporation.
†Wet weight
NC = Not collected

TABLE E-2. PLUTONIUM AND STRONTIUM CONCENTRATIONS IN BONES (HOCK), DESERT BIGHORN SHEEP, 1976*

Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg[†])	^{239}Pu (fCi/g Ash) (fCi/kg[†])	^{89}Sr (pCi/g Ash) (pCi/kg[†])	^{90}Sr (pCi/g Ash) (pCi/kg[†])	Ash (%)
1	13 ± 4.1 3,400 ± 1,100	2.5 ± 1.8 680 ± 490	<2.8 <760	3.5 ± 0.56 950 ± 150	27
2	<2.6 <900	<2.1 <750	<3.4 <1,200	3.4 ± 0.89 1,200 ± 310	35
3		SAMPLE NOT COLLECTED			
4	<1.3 <430	<1.3 <430	<2.6 <850	4.8 ± 0.9 1,600 ± 290	33
5	<1.3 <400	<1.1 <350	<1.8 <550	2 ± 0.45 610 ± 140	31
6		SAMPLE NOT COLLECTED			
7	1.6 ± 1.6 370 ± 370	5.7 ± 2.3 1,300 ± 540	<2 <470	1.8 ± 0.48 420 ± 110	23
8	<1.5 <480	<1.4 <460	<7.9 <2,600	2.1 ± 0.45 690 ± 150	33
9		SAMPLE NOT COLLECTED			
10	<1.4 <300	<0.91 <200	<1.6 <350	2 ± 0.5 430 ± 110	22
11	<1.7 <480	3.6 ± 2.2 1,000 ± 620	<2 <550	1.2 ± 0.43 330 ± 120	28
12		SAMPLE NOT COLLECTED			
13		SAMPLE NOT COLLECTED			
14	<1.4 <370	3.1 ± 2 840 ± 550	<1.1 <290	0.7 ± 0.34 190 ± 92	27
15	<1.6 <570	<0.9 <340	5 ± 2.1 1,800 ± 740	1.9 ± 0.47 680 ± 170	36
16	<1.7 <610	<1.2 <430	<2.3 <820	3.3 ± 0.67 1,200 ± 240	36
17		SAMPLE NOT COLLECTED			

TABLE E-2. PLUTONIUM AND STRONTIUM CONCENTRATIONS IN BONES (HOCK), DESERT BIGHORN SHEEP, 1976* (continued)

Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	^{89}Sr (pCi/g Ash) (pCi/kg†)	^{90}Sr (pCi/g Ash) (pCi/kg†)	Ash (%)
18	6.1 ± 2.2 1,700 ± 630	7.5 ± 2.5 2,100 ± 700	<8.9 <2,500	3.9 ± 0.68 1,100 ± 190	28
19	<2.5 <980	<2.1 <800	<0.36 <140	4.6 ± 0.72 1,800 ± 280	39
20	3.4 ± 1.8 860 ± 460	100 ± 12 25,000 ± 3,000	<2.8 <700	5.6 ± 0.72 1,400 ± 180	25
Median	<1.7 <528	<2.1 <715	<2 <730	2.7 820	29.5
Range	<1.3-13 <300-3,400	<1.1-100 <200-25,000	<0.36-<8.9 <140-<2,600	0.7-5.6 190-1,800	22- 39

*All analyses by EMSL-LV.

†Wet weight

TABLE E-3. GAMMA-EMITTING RADIONUCLIDES AND TRITIUM CONCENTRATIONS IN SELECTED TISSUES, DESERT BIGHORN SHEEP, 1976*

	RUMEN CONTENTS	LIVER	LUNG	KIDNEYS
Animal No.	K (g/kg†) ^{137}Cs (pCi/kg†) ^{95}Zr (pCi/kg†)	K (g/kg†)	K (g/kg†)	K (g/kg†) ^{3}H (pCi/l) ^{137}Cs (pCi/kg†)
1	6 ± 0.37 62 ± 25 630 ± 110	6.4 ± 0.48	11 ± 0.96	3.9 ± 0.39 <277 <MDA
2	4.7 ± 0.28 59 ± 15 420 ± 80	7.3 ± 0.6	2.9 ± 0.34	3.8 ± 0.4 <277 301 ± 278
3	2.2 ± 0.37 38 ± 26 450 ± 81	3.5 ± 0.46	3.1 ± 0.35	2.5 ± 0.67 <307 39 ± 8.8
4	4 ± 0.34 23 ± 18 670 ± 80	3.1 ± 0.24	2.5 ± 0.36	1.9 ± 0.54 <279 <MDA
5	NC	NC	9.7 ± 0.93	3.1 ± 0.52 <307 34 ± 5.6
6	4.7 ± 0.27 74 ± 14 620 ± 71	3.4 ± 0.25	1.9 ± 0.21	2.2 ± 0.4 <307 21 ± 8
7	4.2 ± 0.58 67 ± 28 <MDA	2.9 ± 0.27	9 ± 0.79	3.1 ± 0.57 <307 <MDA
8	3.6 ± 0.4 <MDA <MDA	3 ± 0.52	3.3 ± 0.33	2 ± 0.71 <307 <MDA
9	3.6 ± 0.58 <MDA 220 ± 110	3.3 ± 0.24	9,3 ± 0.98	3.1 ± 0.45 270 ± 240 <MDA
10	4.5 ± 0.42 27 ± 21 500 ± 73	2.3 ± 0.22	8.5 ± 0.91	2.3 ± 0.7 473 ± 282 <MDA

TABLE E-3. GAMMA-EMITTING RADIONUCLIDES AND TRITIUM CONCENTRATIONS IN SELECTED TISSUES, DESERT BIGHORN SHEEP, 1976* (continued)

	RUMEN CONTENTS	LIVER	LUNG	KIDNEYS
Animal No.	K (g/kg†) ^{137}Cs (pCi/kg†) ^{95}Zr (pCi/kg†)	K (g/kg†)	K (g/kg†)	K (g/kg†) ^{3}H (pCi/l) ^{137}Cs (pCi/kg†)
11	4.6 ± 0.25 59 ± 12 <MDA	7.2 ± 0.58	2.6 ± 0.33	3.2 ± 0.28 <277 <MDA
12	3.5 ± 0.31 53 ± 16 620 ± 77	3.4 ± 0.26	9 ± 0.85	2.1 ± 0.91 <307 48 ± 6.4
13	3.9 ± 0.35 <MDA 610 ± 73	3.2 ± 0.39	11 ± 0.91	2.6 ± 0.21 <277 <MDA
14	4 ± 0.41 <MDA <MDA	2.1 ± 2	11 ± 1	1.9 ± 0.71 321 ± 301 <MDA
15	2.5 ± 0.31 <MDA 710 ± 73	7.5 ± 0.56	11 ± 0.99	1.6 ± 0.67 <307 32 ± 6.3
16	6.6 ± 0.27 <MDA 230 ± 51	3.2 ± 0.24	3.4 ± 0.35	2.9 ± 0.21 <307 <MDA
17	4.3 ± 0.36 55 ± 19 660 ± 92	8.6 ± 0.86	5.1 ± 0.24	1.9 ± 0.45 279 ± 277 <MDA
18	2.8 ± 0.34 60 ± 17 230 ± 59	8.6 ± 0.86	9.7 ± 0.79	1.1 ± 0.93 560 ± 282 <MDA
19	1.9 ± 0.18 43 ± 12 180 ± 54	6.8 ± 0.63	8.7 ± 0.78	<MDA <277 <MDA
20	NC	5.9 ± 0.41	3.5 ± 0.32	1.2 ± 0.54 <277 <MDA

TABLE E-3. GAMMA-EMITTING RADIONUCLIDES AND TRITIUM CONCENTRATIONS IN SELECTED TISSUES, DESERT BIGHORN SHEEP, 1976* (continued)

	RUMEN CONTENTS	LIVER	LUNG	KIDNEYS
Animal No.	K (g/kg†) ^{137}Cs (pCi/kg†) Zr (pCi/kg†)	K (g/kg†)	K (g/kg†)	K (g/kg†) ^{3}H (pCi/l) ^{137}Cs (pCi/kg†)
Median	4.1 4.1 435	3.5	8.9	2.4 307 <MDA
Range	1.9-6.6 <MDA-74 <MDA-710	2.1-8.6	1.9-11	1.1-3.9 <277-560 <MDA-48

*All analyses by EMSL-LV.
†Wet weight
<MDA = less than minimum detectable activity.
NC = Not collected

APPENDIX F. PLUTONIUM, STRONTIUM, TRITIUM, AND GAMMA-EMITTING RADIONUCLIDES CONCENTRATIONS IN BONES AND MUSCLES, HORSES, NTS, 1976*

Animal No. Tissue Type	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	^{89}Sr (pCi/g Ash) (pCi/kg†)	^{90}Sr (pCi/g Ash) (pCi/kg†)	Ash (%)	K (g/kg†)	^{137}Cs (pCi/kg†)	^{3}H (pCi/l)
Bone #1	18 ± 4.5 3,700 ± 950	47 ± 7.1 9,900 ± 1,500	<2.8 <580	9 ± 1.1 1,900 ± 230	21	NA	NA	NA
Bone #2	<1.7 <390	3.8 ± 2.1 870 ± 490	<0.5 <11	8.7 ± 1.2 2,000 ± 270	25	NA	NA	NA
Muscle #1	<10 <370	<10 <370	NA	NA	3.7	4 ± 0.27	27 ± 11	<220
Muscle #2 Dupl.	<10 <370	<20 <740	NA	NA	3.7	6.9 ± 0.43	<MDA	<300
Muscle #2	<10 <190	<10 <190	NA	NA	1.9	NA	NA	NA
Muscle #2 Dupl.	<10 <190	<10 <190	NA	NA	1.9	NA	NA	NA

*Plutonium analyses by Eberline Instrument Corporation. All other analyses by EMSL-LV.
†Wet weight
NA = Not analyzed

APPENDIX G. PLUTONIUM, STRONTIUM, TRITIUM, AND GAMMA-EMITTING RADIONUCLIDES CONCENTRATIONS IN SELECTED TISSUES, COYOTE, AREA 18, NTS, 1976*

Animal Tissue Type	^{238}Pu (fCi/g Ash) (fCi/kg†)	^{239}Pu (fCi/g Ash) (fCi/kg†)	^{89}Sr (pCi/g Ash) (pCi/kg†)	^{90}Sr (pCi/g Ash) (pCi/kg†)	Ash (%)	K (g/kg†)	^{137}Cs (pCi/kg†)	^{3}H (pCi/l)
Bone	<3.4 <650	<3.4 <650	<11 <2,000	1.6 ± 0.7 310 ± 130	19	NA	NA	NA
Kidney	NA	NA	NA	NA		4.9 ± 0.6	<MDA	
Liver	<10 <200	<10 <200	NA	NA	2.2	2.4 ± 0.1	57 ± 1.5	
Lung	14 ± 11 140 ± 110	10 ± 8.5 100 ± 82	NA	NA	0.97	3.3 ± 0.2	32 ± 3.7	
Stomach Contents	45 ± 9.5 1,700 ± 360	340 ± 34 13,000 ± 1,300	NA	NA	3.8	2.3 ± 0.7	56 ± 7.3	
Muscle	0.4 ± 0.2 8 ± 4.4	<0.1 <2.3	NA	NA	2.1	4.7 ± 0.3	41 ± 3.4	4,600 ± 360
Skin	30 ± 20 980 ± 650	480 ± 100 16,000 ± 3,000	NA	NA	3.3	<MDA	210 ± 20	

*Plutonium analyses by Eberline Instrument Corporation. All other analyses by EMSL-LV.
†Wet weight
NA = Not analyzed
<MDA = Less than minimum detectable activity.

TABLE H-1. PLUTONIUM CONCENTRATIONS IN SELECTED TISSUES, RABBITS, AREA 18, NTS, MAY 1976

Animal No.	MUSCLES			INTERNAL ORGANS			G.I. TRACT		
	^{238}Pu (fCi/g Ash) (fCi/kg*)	^{239}Pu (fCi/g Ash) (fCi/kg*)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg*)	^{239}Pu (fCi/g Ash) (fCi/kg*)	Ash (%)	^{238}Pu (pCi/g Ash) (pCi/kg*)	^{239}Pu (pCi/g Ash) (pCi/kg*)	Ash (%)
1	NA	NA	NA	11 ± 1.2† 120 ± 13†	≤0.17† <1.9†	1.1†	<0.03 <0.8	<0.03 <0.8	2.7
2	17 ± 7.5 340 ± 150	26 ± 9.5 510 ± 190	2	9 ± 1† 97 ± 14†	90 ± 30† 940 ± 320†	1.1†	0.1 ± 0.03 2.7 ± 0.8	0.71 ± 0.12 19 ± 3	2.7
3	<10 <650	20 ± 10 1,300 ± 600	6.6	<30 <650	100 ± 40 2,200 ± 800	2.2	<0.02 <1.2	0.17 ± 0.02 10 ± 1	6
4	<10 <150	<60 <920	1.5	<10 <130	120 ± 60 1,600 ± 0.8	1.3	0.04 ± 0.02 0.7 ± 0.35	0.42 ± 0.08 7.4 ± 1.4	1.8
5	360 ± 90 2,200 ± 500	9,900 ± 1,100 60,000 ± 7,000	0.6	<20 <500	340 ± 70 8,600 ± 1,800	2.5	0.72 ± 0.15 18 ± 4	10 ± 2 250 ± 50	2.5
6	93 ± 19† 1,200 ± 240†	10 ± 7.3† 130 ± 95†	1.3	<10 <230	<10 <230	2.3	0.06 ± 0.04 1.4 ± 0.9	0.52 ± 0.12 12 ± 3	2.3
7	<10 <130	70 ± 40 930 ± 530	1.3	<10 <120	160 ± 60 2,000 ± 700	1.2	SL	SL	SL
Median	<10 <650	<65 925	1.5	<10 <130	100 1,600	1.3	0.05 1.3	0.47 11	2.7
Range	<10-360 <130-2,200	<60-9,900 130-60,000	0.6-6.6	9-30 97-<650	<0.17-340 <1.9-8,600	1-2.5	<0.02-0.72 <0.8-18	<0.03-10 <0.8-250	1.8-6

*Wet weight

†Plutonium analyses by EMSL-LV. All other plutonium analyses by Eberline Instrument Corporation.

NA = Not analyzed

SL = Sample lost

TABLE H-2. PLUTONIUM AND STRONTIUM CONCENTRATIONS FROM BONE AND SKIN, RABBITS, AREA 18, NTS, MAY 1976

	Bone					Skin		
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg)	^{239}Pu (fCi/g Ash) (fCi/kg)	^{89}Sr (pCi/g Ash) (pCi/kg)	^{90}Sr (pCi/g Ash) (pCi/kg)	Ash (%)	^{238}Pu (pCi/g Ash) (pCi/kg)	^{239}Pu (pCi/g Ash) (pCi/kg)	Ash (%)
1	<3.2 <380	17 ± 4 2,100 ± 480	<17 <2,000	5.3 ± 1 640 ± 120	13	0.22 ± 0.03[†] 22 ± 2.6[†]	5.3 ± 0.39[†] 530 ± 39[†]	1.8[†]
2	<6.2 <800	<6.2 <800	<15 <1,900	6.2 ± 1 800 ± 130	12.4	0.19 ± 0.04 7.3 ± 1.5	1.6 ± 0.2 61 ± 8	3.8
3	<6.8 <680	<1.7 <170	<15 <1,500	4.8 ± 0.99 480 ± 99	10	0.14 ± 0.04 7.1 ± 2	0.95 ± 0.14 48 ± 7	5.1
4	<2.9 <320	<2.9 <320	<13 <1,400	3.8 ± 0.85 420 ± 94	11	0.26 ± 0.06 9.5 ± 2.2	1.9 ± 0.3 69 ± 11	3.6
5	9 ± 7.2 450 ± 360	60 ± 20 3,000 ± 990	<13 <650	3.8 ± 0.86 190 ± 43	5	0.16 ± 0.02 16 ± 2	4.2 ± 0.2 430 ±20	10
6	<4.4 <350	<4.4 <350	<19 <1,500	6.9 ± 1.2 550 ± 95	8	0.34 ± 0.08 20 ± 5	6.2 ± 0.7 370 ± 40	6
7	<4.2 <420	<1.3 <130	<11 <1,100	2.6 ± 0.69 260 ± 69	10	0.17 ± 0.05 11 ± 3	1.1 ± 0.2 70 ± 13	6.3
Median	<4.4 <420	<4.4 <350	<15 <1,500	4.8 480	10	0.19 11	1.9 70	10
Range	<2.9-9 <320-800	<1.3-60 <130-3,000	<11-<19 <650-<2,000	2.6-6.9 190-800	5- 13	0.14-0.34 7.1-22	0.95-6.2 48-530	1.8- 6.3

*Wet weight

[†] Plutonium analyses by EMSL-LV. All other plutonium analyses by Eberline Instrument Corporation. Strontium analyses by EMSL-LV.

TABLE H-3. GAMMA-EMITTING RADIONUCLIDES AND TRITIUM CONCENTRATIONS IN SELECTED TISSUES, RABBITS, AREA 18, NTS, MAY 1976*

Animal No.	MUSCLES K (g/kg†) ^{137}Cs (pCi/kg†) ^{3}H (pCi/l)	SKIN K (g/kg†) ^{137}Cs (pCi/kg†)	G.I. TRACT K (g/kg†) ^{137}Cs (pCi/kg†)	INTERNAL ORGANS K (g/kg†) ^{137}Cs (pCi/kg†)
1	4.1 ± 1.9 <MDA 610 ± 230	2.8 ± 1.8 130 ± 31	3 ± 0.32 <MDA	3.2 ± 0.72 <MDA
2	3.6 ± 0.45 19 ± 6.7 740 ± 290	4.5 ± 0.47 120 ± 9	5 ± 0.26 <MDA	4.4 ± 0.38 <MDA
3	3.4 ± 0.21 16 ± 2.7 320 ± 290	4.1 ± 0.7 71 ± 9	4.2 ± 0.38 40 ± 5.5	2.5 ± 1 <MDA
4	3.3 ± 0.6 24 ± 12 970 ± 300	8.2 ± 0.7 120 ± 33	3.1 ± 0.24 25 ± 2.5	3 ± 0.44 25 ± 5.9
5	2.4 ± 0.65 36 ± 5.4 680 ± 230	NA NA	3.3 ± 0.38 23 ± 9.8	4.5 ± 0.7 <MDA
6	4 ± 0.57 <MDA 650 ± 230	7.3 ± 1.1 350 ± 28	2.1 ± 0.79 <MDA	4.9 ± 0.87 <MDA
7	3 ± 0.26 19 ± 2.8 680 ± 230	8.3 ± 0.8 130 ± 47	GSN	2.1 ± 0.32 <MDA
Median	3.4 19 680	5.2 125	3.2 25	3.2 <MDA
Range	2.4-4.1 16-36 320-970	2.8-8.3 71-350	2.1-5 <MDA-40	2.1-4.9 <MDA-25

*All analyses by EMSL-LV.
†Wet weight
<MDA = less than minimum detectable activity.
NA = Not analyzed
GSN = Gamma spectrum negligible

TABLE I-1. PLUTONIUM CONCENTRATIONS IN SELECTED TISSUES, RABBITS, AREA 15, NTS, MARCH 1976

	MUSCLES			TESTICLES OR FETUS			INTERNAL ORGANS			G.I. TRACT		
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg*)	^{239}Pu (fCi/g Ash) (fCi/kg*)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg*)	^{239}Pu (fCi/g Ash) (fCi/kg*)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg*)	^{239}Pu (fCi/g Ash) (fCi/kg*)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg*)	^{239}Pu (fCi/g Ash) (fCi/kg*)	Ash (%)
1	7.5 ± 5.6† 98 ± 73†	12 ± 5.8† 160 ± 75†	1.3†	<28 <1,400	<28 <1,400	5	50 ± 15† 1,200 ± 370†	150 ± 27† 3,700 ± 640†	2.4†	14 ± 7 1,100 ± 560	200 ± 27 16,000 ± 2,200	8
2	<33 <330	<33 <330	1	<23‡ <230‡	<28‡ <230‡	1‡	1,400 ± 300 14,000 ± 3,000	400 ± 140 4,000 ± 1,400	1	37 ± 13 400 ± 390	570 ± 60 12,000 ± 1,800	3
3	<11 <110	91 ± 32 910 ± 320	1	<10‡ <150‡	<10‡ <150‡	1.5‡	140 ± 33† 2,900 ± 660†	150 ± 31† 3,000 ± 630†	2†	3,000 ± 340 30,000 ± 3,400	160,000 ± 12,000 1,600,000 ± 120,000	1
4	240 ± 100 2,400 ± 1,000	<22 <220	1	NC NC	NC NC		<5,000† <600†	130 ± 70† 1,600 ± 840†	1.2†	340 ± 50 22,000 ± 3,000	7,500 ± 500 480,000 ± 30,000	6.4
5	19 ± 13 390 ± 250	37 ± 19 740 ± 390	2	130 ± 70 3,800 ± 2,100	470 ± 130 14,000 ± 3,800	3	5 ± 3.2 400 ± 260	110 ± 16 8,500 ± 1,300	8	75 ± 13 1,500 ± 270	1,800 ± 80 36,000 ± 1,600	2
Median	19 <330	<33 <330	1	<26 <815	<28 <815	4	140 1,200	150 3,700	2	75 1,500	1,800 36,000	3
Range	7.5-240 98-2,400	12-91 160-910	1-2	<10-130 <150-3,800	<10-470 <150-14,000	1-5	5-<5,000 400-14,000	110-400 1,600-8,500	0.012-8	14-3,000 400-30,000	200-160,000 12,000-1,600,000	1-8

*Wet weight

†Plutonium analyses by EMSL-LV. All other analyses by Eberline Instrument Corporation.

‡Fetus sample

NC = Not collected

TABLE I-2. PLUTONIUM AND STRONTIUM CONCENTRATIONS IN BONE AND SKIN, RABBITS, AREA 15, NTS, MARCH 1976

	BONE					SKIN		
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg*)	^{239}Pu (fCi/g Ash) (fCi/kg*)	^{89}Sr (pCi/g Ash) (pCi/kg*)	^{90}Sr (pCi/g Ash) (pCi/kg*)	Ash (%)	^{238}Pu (fCi/g Ash) (fCi/kg*)	^{239}Pu (fCi/g Ash) (fCi/kg*)	Ash (%)
1	2.6 ± 1.9 310 ± 230	10 ± 3.3 1,200 ± 400	<9.2 <1,100	23 ± 4.8 2,700 ± 580	12	530 ± 110† 16,000 ± 3,400†	3,700 ± 400† 110,000 ± 12,000†	3†
2	15 ± 4.2 2,000 ± 540	9.2 ± 3.2 1,200 ± 420	6.8 ± 2.8 880 ± 370	1.6 ± 0.65 210 ± 85	13	700 ± 130† 14,000 ± 2,500†	14,000 ± 1,000† 290,000 ± 21,000†	2†
3	51 ± 10 9,100 ± 1,800	9.4 ± 4.3 1,700 ± 720	<3.1 <560	2.9 ± 0.71 530 ± 130	18	900 ± 230† 27,000 ± 6,900†	30,000 ± 4,000† 890,000 ± 120,000†	3†
4	4.8 ± 3.2 470 ± 310	30 ± 7.7 2,900 ± 750	<12 <1,200	16 ± 2.3 1,600 ± 220	9.7	320 ± 34† 26,000 ± 2,700†	2,500 ± 140† 200,000 ± 11,000†	8†
5	<1 <190	27 ± 5.1 5,200 ± 960	<16 <3,000	95 ± 8.4 18,000 ± 1,600	19	134 ± 17† 19,300 ± 2,500†	4,610 ± 370† 663,000 ± 53,000†	14.4†
Median	4.8 470	10 1,700	<16 <3,000	95 13,000	13	530 19,300	4,610 290,000	3
Range	<1-51 <190-9,100	9.2-30 1,200-5,200	<12-620 <1,100-81,000	16-100 1,600-18,000	9.7-19	134-900 14,000-27,000	2,500-30,000 110,000-890,000	2-14.4

*Wet weight

†Actinide analyses by Eberline Insturment Corporation. All other analyses by EMSL-LV.

TABLE I-3. GAMMA-EMITTING RADIONUCLIDES AND TRITIUM CONCENTRATIONS IN SELECTED TISSUES, RABBITS, AREA 15, NTS, MARCH 1976*

Animal No.	MUSCLES K (g/kg†) ^{137}Cs (pCi/kg†) ^{3}H (pCi/l)	SKIN K (g/kg†) ^{137}Cs (pCi/kg†)	TESTICLES OR FETUS K (g/kg†) ^{137}Cs (pCi/kg†)	G.I. TRACT K (g/kg†) ^{137}Cs (pCi/kg†)	INTERNAL ORGANS K (g/kg†) ^{137}Cs (pCi/kg†)
1	4.5 ± 0.3 51 ± 8.2 3,700 ± 310	GSN GSN	5 ± 2.7 <MDA	3 ± 0.57 <MDA	2.3 ± 2 <MDA
2	6.9 ± 1.4 NC 2,300 ± 290	<MDA 210 ± 77	1.7 ± 0.7‡ <MDA‡	3.6 ± 0.61 110 ± 8.4	2.4 ± 0.89 <MDA
3	4.3 ± 0.29 52 ± 0.34 28,000 ± 550	2.7 ± 1.1 120 ± 30	2.7 ± 1.1‡ <MDA‡	2.9 ± 0.84 46 ± 10	2.4 ± 2.1 <MDA
4	3.6 ± 0.4 130 ± 14 5,100 ± 320	6.9 ± 4.7 620 ± 92	NC NC	4.3 ± 1 400 ± 21	6.6 ± 1.4 <MDA
5	3.4 ± 0.33 160 ± 4.9 2,400 ± 290	NA NA	6 ± 1.5 160 ± 21	4.3 ± 0.36 120 ± 9.5	2.8 ± 0.65 56 ± 10
Median	4.3 91 3,700	2.7 165	3.9 <MDA	3.6 110	2.4 <MDA
Range	3.4-6.9 51-160 2,300-28,000	<MDA-6.9 <MDA-620	1.7-6 <MDA-160	2.9-4.3 <MDA-400	2.4-6.6 <MDA-56

*All analyses by EMSL-LV.
†Wet weight
GSN = Gamma spectrum negligible
<MDA = less than minimum detectable activity.
‡Fetus samples
NC = Not collected

TABLE J-1. PLUTONIUM CONCENTRATIONS IN SELECTED TISSUES, RABBITS, AREA 15, NTS, SEPTEMBER 1976

	MUSCLES			INTERNAL ORGANS			G.I. TRACT		
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg*)	^{239}Pu (fCi/g Ash) (fCi/kg*)	Ash (%)	^{238}Pu (pCi/g Ash) (pCi/kg*)	^{239}Pu (pCi/g Ash) (pCi/kg*)	Ash (%)	^{238}Pu (pCi/g Ash) (pCi/kg*)	^{239}Pu (pCi/g Ash) (pCi/kg*)	Ash (%)
A	SL SL	SL SL	SL	0.065 ± 0.014† 1.3 ± 0.28†	0.031 ± 0.011† 0.63 ± 0.22†	2†	0.48 ± 0.08 17 ± 3	3.7 ± 0.4 130 ± 15	3.5
B	<12† <160†	24† ± 15 310 ± 190†	1.3†	0.17 ± 0.11 2.7 ± 1.7	1.5 ± 0.4 23 ± 6	1.6	0.05 ± 0.01 3.9 ± 0.8	0.54 ± 0.07 42 ± 5	7.8
C	<8.6† <120	<8.6† <120	1.4†	<0.01 <0.22	<0.01 <0.22	2.2	0.26 ± 0.06 6.5 ± 1.5	9.3 ± 0.9 230 ± 20	2.5
D	<18† <230†	<19† <250†	1.3†	<0.01 <0.13	0.18 ± 0.12 2.4 ± 1.6	1.3	0.46 ± 0.09 19 ± 4	20 ± 2 810 ± 80	4.1
E	<6.3† <88†	<7.1† <99†	1.4†	0.1 ± 0.05 2.1 ± 1	3.1 ± 0.4 64 ± 8	2.1	1.1 ± 0.1 27 ± 2	40 ± 3 970 ± 70	2.4
F	<20 <840	<20 <840	4.2	0.41 ± 0.17 6.4 ± 2.7	0.84 ± 0.15 13 ± 2	1.6	0.48 ± 0.08 10 ± 2	18 ± 2 390 ± 40	2.2
Median	<12 <160	<19 310	1.4	0.083 1.7	0.52 7.7	1.8	0.47 13.5	13.6 310	3
Range	<6.3-<18 <88-<840	<7.1-24 <99-<840	1.3- 4.2	<0.01-0.41 <0.13-6.4	<0.01-3.1 <0.22-64	1.3-2.2 1.3-2.2	0.05-1.1 3.9-27	0.54-40 42-970	2.2- 7.8

*Wet weight

†Plutonium analyses by EMSL-LV. All other analyses by Eberline Instrument Corporation.

SL = Sample lost

TABLE J-2. PLUTONIUM AND STRONTIUM CONCENTRATIONS IN BONE AND SKIN, RABBITS, AREA 15, NTS, SEPTEMBER 1976

	BONE					SKIN		
Animal No.	^{238}Pu (fCi/g Ash) (fCi/kg*)	^{239}Pu (fCi/g Ash) (fCi/kg*)	^{89}Sr (pCi/kg Ash) (pCi/kg*)	^{90}Sr (pCi/kg Ash) (pCi/kg*)	Ash (%)	^{238}Pu (pCi/g Ash) (pCi/kg*)	^{239}Pu (pCi/g Ash) (pCi/kg*)	Ash (%)
A	20 ± 5.3 3,800 ± 1,000	9.5 ± 3.7 1,800 ± 700	<4.5 <850	4.6 ± 0.79 870 ± 150	19	SL SL	SL SL	SL
B	5.7 ± 2.8 1,300 ± 640	25 ± 5.2 5,800 ± 1,200	<5 <1,200	6.3 ± 0.92 1,500 ± 220	23	0.22 ± 0.07† 3.5 ± 1.1†	3.4 ± 0.4† 54 ± 6†	1.6†
C	<3.4 <710	13 ± 5.2 2,700 ± 1,100	<4.6 <960	5.2 ± 0.86 1,100 ± 180	21	0.08 ± 0.05† 1.2 ± 0.7†	0.92 ± 0.19† 14 ± 3†	1.5†
D	7.5 ± 5 1,500 ± 1,000	8 ± 5.5 1,600 ± 1,100	<4.7 <940	7 ± 0.9 1,400 ± 180	20	0.72 ± 0.12† 15 ± 3†	30 ± 2† 640 ± 40†	2.1†
E	11 ± 3.9 2,400 ± 810	8.6 ± 3.3 1,800 ± 700	<5.7 <1,200	6.7 ± 1 1,400 ± 210	21	0.12 ± 0.04† 1.6 ± 0.5†	3.9 ± 0.4† 52 ± 5†	1.3†
F	2.4 ± 0.76 410 ± 13	1.2 ± 0.54 210 ± 91	NA NA	5.8 ± 1 990 ± 170	17	SL SL	SL SL	SL
Median	6.1 1,400	9 1,800	<4.7 <960	6 1,250	20.5	0.17 2.6	2.7 33	1.6
Range	2.4-20 410-2,400	1.2-25 210-5,800	<4.5-<5.7 <850-<1,200	4.6-7 870-1,500	17- 23	0.08-0.72 1.2-15	0.92-30 14-640	1.3- 2.1

*Wet weight
SL = Sample lost
†Plutonium analyses by Eberline Instrument Corporation. All other analyses by EMSL-LV.
NA = Not analyzed

TABLE J-3. GAMMA-EMITTING RADIONUCLIDES AND TRITIUM CONCENTRATIONS IN SELECTED TISSUES, RABBITS, AREA 15, NTS, SEPTEMBER 1976*

	MUSCLES	SKIN	G.I. TRACT	INTERNAL ORGANS
Animal No.	K (g/kg †) ^{137}Cs (pCi/kg†) ^{3}H (pCi/l)	K (g/kg†) ^{137}Cs (pCi/kg†)	K (g/kg†) ^{137}Cs (pCi/kg†) ^{95}Zr (pCi/kg†)	K (g/kg†)
A	2.9 ± 0.51 74 ± 5.7 4,800 ± 340	2.2 ± 1.4 92 ± 76	17 ± 1.2 200 ± 59 2,900 ± 390	GSN
B	2.6 ± 0.97 48 ± 8.1 4,300 ± 340	3.4 ± 0.97 110 ± 50	7.2 ± 0.4 120 ±20 300 ± 200	2.7 ± 1.3
C	3.4 ± 0.47 27 ± 5.6 5,300 ± 350	1.5 ± 0.94 <MDA	7.2 ± 0.62 130 ± 32 550 ± 270	4.8 ± 2.5
D	3.4 ± 1.2 55 ± 12 7,300 ± 380	3.5 ± 1.5 <MDA	4.2 ± 0.66 170 ± 47 <MDA	4.6 ± 2.5
E	2.5 ± 0.36 37 ± 3.2 14,000 ± 450	2.2 ± 0.79 50 ± 41	8.7 ± 0.63 180 ± 31 <MDA	5 ± 2.2
F	3.9 ± 0.42 77 ± 7.6 NA	4.3 ± 8.8 100 ± 46	7.5 ± 0.43 170 ± 21 <MDA	3.3 ± 2.1
Median	3.2 52 5,050	2.8 71	7.4 170 300	4.6
Range	2.5-3.9 27-77 4,300-14,000	1.5-4.3 <MDA-110	4.2-17 120-200 <MDA-2,900	2.7-5

*All analyses by EMSL-LV.

†Wet weight

GSN = Gamma spectrum negligible

<MDA - Less than minimum detectable activity

NA = Not analyzed

APPENDIX K. PLUTONIUM STRONTIUM, TRITIUM, AND GAMMA-EMITTING RADIONUCLIDES CONCENTRATIONS IN SELECTED TISSUES, CHUKAR AND QUAIL, AREA 15, NTS, 1976

Tissue Type	^{238}Pu (pCi/g Ash) (pCi/kg*)	^{239}Pu (pCi/g Ash) (pCi/kg*)	^{89}Sr (pCi/g Ash) (pCi/kg*)	^{90}Sr (pCi/g Ash) (pCi/kg*)	Ash (%)	K (g/kg*)	^{137}Cs (pCi/kg*)	^{3}H (pCi/l)
Chukar Viscera	SL	SL	SL	SL	SL	9.7 ± 0.67	670 ± 36	NA
Quail Viscera	<0.01[†] <1.7[†]	0.26 ± 0.07[†] 43 ± 12[†]	NA	NA	16.6	18 ± 1.9	180 ± 91	NA
Chukar Feathers	0.16 ± 0.026[†] 15 ± 2.5[†]	5.3 ± 0.61[†] 500 ± 58[†]	NA	NA	9.5	NA	NA	NA
Quail Feathers	0.73 ± 0.20[†] 22 ± 6[†]	13 ± 2[†] 390 ± 60[†]	NA	NA	3	3.4 ± 3.2	390 ± 180	NA
Chukar Bone	<0.0012 <0.18	0.0053 ± 0.0025 0.79 ± 0.37	6.7 1,000	8.7 ± 1.2 1,300 ± 180	15	NA	NA	NA
Quail Bone	<0.01 <1.1	0.091 ± 0.025 10 ± 2.7	3.8 420	3.6 ± 0.74 400 ± 81	11	NA	NA	NA
Chukar Muscle	0.025 ± 0.011 0.3 ± 0.13	0.0092 ± 0.0072 0.11 ± 0.087	NA	NA	1.2	2.8 ± 0.45	49 ± 5.4	1,600 ± 300
Quail Muscle	0.024 ± 0.021 0.31 ± 0.27	0.11 ± 0.032 1.4 ± 0.42	NA	NA	1.3	3.6 ± 0.67	<MDA	1,900 ± 300

*Wet weight
SL = Sample lost
[†] Plutonium analyses by Eberline Instrument Corporation. All other analyses by EMSL-LV.
NA = Not analyzed
<MDA = less than minimum detectable activity.

APPENDIX L. GROSS* AND MICROSCOPIC PATHOLOGY† FOUND IN NECROPSIED ANIMALS

AREA 18 CATTLE, APRIL

1

Necropsy findings: No gross lesions noted. Uterus contained an 8-month-old male fetus.

Histopathological findings: Mild hemosiderosis of the spleen and sarcocysts in the cardiac muscle.

Hematological findings:‡ RBC/cmm 6.9×10^6, WBC/cmm 5×10^3, MCV/cu.μ 57, Hb g% 14.7, Hematocrit % 39.

Clinical diagnosis: Normal, pregnant, mature cow.

Fetus-1

Necropsy findings: No gross lesions noted.

Histopathological findings: Extensive hematopoiesis of the spleen with foci of hematopoiesis in the liver.

Hematological findings: Blood sample not collected.

Clinical diagnosis: Normal 8-month-old male fetus.

2

Necropsy findings: A small abscess (1 to 2 cm in diameter) that contained a creamy white exudate, was found in the intermandibular space. Rubber fragments were found in reticulum sediment.

Histopathological findings: The abscess wall showed inflammatory reaction with some bacterial colonies.

Hematological findings: RBC/cmm 9×10^6, WBC/cmm 9.1×10^3, MCV/cu.μ 74, Hb g% 16.2, Hematocrit % 67.

Clinical diagnosis: Normal heifer with beginning actinobacillosis (lumpy-jaw).

3

Necropsy findings: There was a small papilloma on the left cornea and some emphysema of the lungs from agonal struggling.

Histopathological findings: Moderate hemosiderosis of spleen, mild fatty changes in liver, capsular melanosis of the adrenal, hyperplasia of tracheobronchial lymph node, and mild hyperplasia of the arterial muscular walls in the lungs.

APPENDIX L. GROSS* AND MICROSCOPIC PATHOLOGY† FOUND IN NECROPSIED ANIMALS (continued)

AREA 18 CATTLE, APRIL (continued)

3

Hematological findings: RBC/cmm 7×10^6, WBC/cmm 3.5×10^3, MCV/cu.μ 62, Hb g% 15, Hematocrit % 44.

Clinical diagnosis: Normal, mature steer.

4

Necropsy findings: No gross lesions noted. Approximately 3 meters of 1.5-cm diameter nylon rope in rumen.

Histopathological findings: Observations included moderate hemosiderosis of the spleen, mild fatty changes in the liver, and lymphoid hyperplasia of a tracheobronchial lymph node.

Hematological findings: RBC/cmm 7.3×10^6, WBC/cmm 5.2×10^3, MCV/cu.μ 64, Hb g% 13.4, Hematocrit % 47.

Clinical diagnosis: Normal 3-year-old steer.

5

Necropsy findings: No gross lesions noted.

Histopathological findings: Kidney contained focal interstitial lymphoid aggregates.

Hematological findings: RBC/cmm 9×10^6, WBC/cmm 5.2×10^3, MCV/cu.μ 52, Hb g% 14.2, Hematocrit % 47.

Clinical diagnosis: Normal 2-year-old steer.

6

Necropsy findings: No gross lesions noted.

Histopathological findings: There was melanosis of the adrenal capsule and some lymphoid hyperplasia of the tracheobronchial lymph nodes.

Hematological findings: RBC/cmm 10×10^6, WBC/cm 3×10^3, MCV/cu.μ 43, Hb g% 16.4, Hematocrit % 43.

Clinical diagnosis: Normal 3-year-old steer.

AREA 18 CATTLE, OCTOBER

7

Necropsy findings: Appears to have cirrhosis of the liver with ascites. Lungs were emphysematous probably as a result of agonal struggling.

Histopathological findings: There was moderate hemosiderosis of the spleen, thickened pleura of the lung, and multifocal lymphoid aggregates in the liver.

Hematological findings: The CBC may be altered due to fibrin clots in the sample. RBC/cmm 7.8×10^6, WBC/cmm 3.8×10^3, MCV/cu.μ 55, Hb g% 12.9, Hematocrit % 43.

Cinicial diagnosis: Normal steer

8

Necropsy findings: Atelectic areas in margins of left apical and cardiac lobes of the lungs.

Histopathological findings: Focal area of hemorrhage in the lungs, moderate hemosiderosis of the spleen, and melanosis of the capsule of the adrenals.

Hematological findings: The analytical laboratory noted that the complete blood count may be altered due to many fibrin clots in the sample. RBC/cmm 10×10^6, WBC/cmm 2.3×10^3, MCV/cu.μ 43, Hb g% 12.6, Hematocrit % 43.

Clinical diagnosis: Normal cow.

9

Necropsy findings: Cow was nearly toothless. Had a draining abscess on right intermandibular space. The rumen contained a large mass of ropes (approximately 60 cm in diameter) that has become encapsulated with mineral deposits.

Histopathological findings: Focal areas of chronic scar tissue were found in the liver. The abscess wall consisted of fibrous tissues surrounding the suppurative exudate. Ductular remanents of salivary tissue were incarcerated by these fibrous elements. There is hemosiderosis observed in the spleen.

Hematological findings: The analytical laboratory noted that the reported values might have been altered by fibrin clots present in the sample. RBC/cmm 5.9×10^6, WBC/cmm 2.6×10^3, MCV/cu.μ 54, Hb g% 10.8, Hematocrit % 32.

Clinical diagnosis: An aged, barren cow suffering from actinobacillosis (lumpy jaw).

APPENDIX L. GROSS* AND MICROSCOPIC PATHOLOGY† FOUND IN NECROPSIED ANIMALS (continued)

AREA 18 CATTLE, OCTOBER (continued)

10

Necropsy findings: No gross lesions noted.

Histopathological findings: No lesions noted. Testes undeveloped.

Hematological findings: RBC/cmm 10.3 × 10^6, WBC/cmm 5.2 × 10^3, MCV/cu.µ 46, Hb g% 14.6, Hematocrit % 47.

Clinical diagnosis: Normal, bull calf

11

Necropsy findings: No gross lesions noted.

Histopathological findings: No lesions noted. Testes undeveloped.

Hematological findings: Sample too clotted for analysis.

Clinical diagnosis: Normal, bull calf.

12

Necropsy findings: No gross lesions noted.

Histopathological findings: No lesions noted. Testes undeveloped.

Hematological findings: RBC/cmm 8.9 × 10^6, WBC/cmm 7 × 10^3, MCV/cu.µ 48, Hb g% 12.9, Hematocrit % 43.

Clinical diagnosis: Normal, bull calf.

AREA 5 CATTLE, MAY

A5-1

Necropsy findings: No gross lesions noted.

Histopathological findings: Those included focal interstitial lymphoid agregates in the kidney, and lymphoid hyperplasic in the tracheobronchial lymph nodes.

Hematological findings: Sample collected prior to death RCB/cmm 8.3 × 10^6, WBC/cmm 6.5 × 10^3, MCV/cu.µ 55, Hb g% 16.2, Hematocrit % 46.

Clinical diagnosis: Normal heifer.

APPENDIX L. GROSS* AND MICROSCOPIC PATHOLOGY† FOUND IN NECROPSIED ANIMALS (continued)

AREA 5 CATTLE, MAY (continued)

A5-2

Necropsy findings: Fibrinous adhesions between reticulum and diaphragm. Atelactic areas in left apical and cardiac lobes of lung. Prominent round ligament of liver.

Histopathological findings: Spleen showed hemosiderosis, sarcocysts were present in the heart and there were areas of alveolar hemorrhage in the lungs.

Hematological findings: Sample collected prior to death. RBC/cm 6.7 × 10^6, WBC/cmm 6.9 × 10^3, MCV/cu.μ 57, Hb g% 13.3, Hematocrit % 38.

Clinical diagnosis: Normal, mature cow.

A5-3

Necropsy findings: Adhesion between rumen and liver. Small abscess 3 cm in diameter was found in the liver below the adhesions.

Histopathological findings: Random focal aggregates at neutrophils and lymphocytes in the liver tissue indicate mild subacute plus chronic focal hepatitis. Lung tissue contains parabronchial lymphoid nodules.

Hematological findings: Sample collected prior to death. RBC/cmm 8.2 × 10^6, WBC/cmm 4.1 × 10^3, MCV/cu.μ 57, Hb g% 16.2, Hematocrit % 47.

Clinical diagnosis: Liver abscess possibly from traumatic reticulitis.

Cow 286

History: This heifer was apparently pregnant with developing udder. It was noted on May 7 that she was moving peculiarly--her rear feet were far under her body and she walked on the tips of her hooves. Constant slopping or dribbling of urine was noted when moved. Animal became progressively weaker in the back legs until completely paralyzed from below the hocks. On May 11, the animal was examined, was bright and alert, was able to move on rear legs but weight rested on hocks. Urinary incontinence was noted. Rectal examination revealed a greatly distended bladder and evidence of constipation. No fetus was felt. Treated with 500 cc of calcium, magnesium, and phosphorus salts intravenously, and azium. Tentative diagnosis was pressure on spinal cord from trauma or warble.

Necropsy findings: Subcutaneous tissues of rear legs were very edematous. Fibrous adhesions were found between reticulum and diaphragm. An infarct was found in the liver. Uterus was swollen. Bladder was thickened and edematous. Lungs were emphysematous and contained a frothy exudate probably from agonal struggling. There was an area of edema in tissue around the spinal cord at the least lumbar and first sacral vertebrae.

Cow 286 (continued)

Histopathological findings: Focal interstitial lymphoid aggregates were found in the kidneys. The spinal cord exhibited mild Wallerian degeneration. There was mild inflammation of the uterus probably related to involution. There was extensive hemorrhage and edema in the lungs. Sarcocysts were present in the cardiac muscle. The bladder exhibited mild submucosal edema and inflammation.

Hematological findings: Sample was not collected.

Clinical diagnosis: Holstein cow suffering from paralysis as result of trauma to spinal cord. The lesions in the spinal cord sample examined microscopically were not of significant magnitude to explain the neurological signs exhibited. The mild degenerative changes noted in the cord could have been related to trauma at a more distant site.

NEVADA TEST SITE MULE DEER

1

Necropsy findings: Skin was grossly abraided. Four ribs broken on right side. Kidney and spleen extensively traumatized.

Histopathological findings: Sarcocysts in muscle tissues and spleen was congested.

Hematological findings: Sample not collected.

Clinical diagnosis: Normal doe killed in collision with motor vehicle.

2

History: Animal was wearing radiotransmitter-equipped collar number one. Animal was captured with capture gun November 11, 1975, when collar was attached and was ear tagged. Tracked to Timber Mountain on January 12, 1976. Radio contact lost about February 4, 1976. No contact until animal was observed in Area 12 on Stockade Wash Road and Power Substation June 2, 1976, and again in Burn Valley July 2, 1976. Animal was collected on Echo Peak July 13, 1976.

Necropsy findings: No gross lesions noted except those associated with trauma of bullet passage.

Histopathological findings: Alvelor hemorrhage in lungs probably from aspiration. Testes undeveloped or hypoplastic.

Hematological findings: Sample not collected.

Clinial diagnosis: Normal, mature male deer

APPENDIX L. GROSS* AND MICROSCOPIC PATHOLOGY† FOUND IN NECROPSIED ANIMALS (continued)

3

Necropsy findings: No gross pathology noted except trauma associated with passage of capture syringe which entered the rumen, deflected downwards, and exited abdominal cavity in front of udder. The large intestine was punctured at least three times.

Histopathological findings: No gross lesions noted except for congestion in the spleen.

Hematological findings: Sample not collected.

Clinical diagnosis: Normal, mature female deer.

4

Necropsy findings: Capture syringe penetrated right apical lobe of lungs. Animal died as a result of internal bleeding. Lungs were filled with blood and spleen was distended.

Histopathological findings: Hemorrhage in lungs and congestion of the spleen. Numerous artifacts in tissues resulting from freezing of the tissues.

Hematological findings: Sample not collected.

Clinical diagnosis: Normal, mature male deer.

5

Necropsy findings: Left rear leg broken above hock by capture syringe. Animal killed by shooting. Bullet passed through right side of body passing through anterior portion of right kidney severing aorta and exited through the rumen. No pathology noted that was not related to injury or bullet wound.

Histopathological findings: Congestion of spleen.

Hematological findings: Sample not collected.

Clinical diagnosis: Normal, mature female deer.

6

Necropsy findings: Extensive trauma to abdominal organs and bones of rear legs as result of collision with motor vehicle.

Histopathological findings: Samples not collected as advanced postmortem changes.

Hematological findings: Sample not collected.

Clinical diagnosis: Normal female deer.

APPENDIX L. GROSS* AND MICROSCOPIC PATHOLOGY† FOUND IN NECROPSIED ANIMALS (continued)

NEVADA TEST SITE HORSES

1 and 2

Both of these horses were victims of collision with motor vehicles. Neither were necropsied and samples were not collected for histopathology or hematology as advanced postmortem changes had occurred. All were apparently normal at the time of death.

NEVADA TEST SITE COYOTE

Necropsy findings: No gross lesions noted except those associated with passage of bullet.

Histopathological findings: Most of samples showed postmortem autolysis. Cross sections of nematode parasites were found in the alveoli. Not able to identify but possibly Filoroides milksii.

Hematological findings: Sample not collected.

Clinical diagnosis: Normal female coyote.

AREA 15 RABBITS, MARCH

1 through 5

All of these rabbits were collected by shotgun fire. All were heavily infested with fleas. No gross or histopathological lesions were noted that were not associated with the trauma of collection except for cuterebra larva found in rabbit number 5. Blood samples were not collected for hematological examination. All were apparently normal at time of death.

AREA 15 RABBITS, SEPTEMBER

A through F

All of these animals were collected by shotgun fire on the evening of September 9. Animals were placed in freezer until necropsied on October 23. Histopathological and hematological samples were not collected. No gross lesions were noted except for a parasitic cyst (possibly hydatidiform) which was found in the subcutaneous tissues of the right thoracic area of rabbit F. All were apparently normal at time of death.

APPENDIX L. GROSS* AND MICROSCOPIC PATHOLOGY† FOUND IN NECROPSIED ANIMALS (continued)

AREA 18 RABBITS, MAY

1 through 7

All of these rabbits were Jackrabbits and were collected by shotgun fire on the evening of May 25. No gross lesions were noted that were not associated with the trauma of collection. Histopathological and hematological samples were not collected. All were apparently normal at time of death.

CHUKAR 1, 2, & 3

QUAIL 1 and 2

All of these birds were collected with a 16-gauge shotgun at the Area 15 farm on the evening of September 9. They were placed in a freezer until necropsied on October 23. No gross lesions were noted. Samples for histopathological and hematological examinations were not collected. All were apparently normal at time of death.

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*As reported by senior author.

†As reported by Dr. Billy C. Ward, College of Veterinary Medicine, Drawer V, Mississippi State University, Starkville, Mississippi.

‡RBC/cmm = number of red blood cells per cubic millimeter of blood
WBC/cmm = number of white blood cells per cubic millimeter of blood
MCV/cu.μ = mean corpuscular volume per cubic micron
Hb g% = hemoglobin expressed in gram percent

APPENDIX M. PLANT SPECIES INGESTED BY DESERT BIGHORN SHEEP DURING 1976

Plant Type	Scientific Name	Common Name
Grasses	*Bromus tectorum*	Brome grass
	Festuca sp.	Fescue grass
	Hilaria jamesii	Galleta grass
	Hilaria rigida	Big galleta grass
	Muhlenbergia porteri	Bush muhly
	Oryzopsis hymenoides	Indian rice grass
	Poa sp.	Bluegrass
	Sitanion hystrix	Squirrel tail grass
	Stipa speciosa	Desert needlegrass
Shrubs	*Ambrosia dumosa*	Burrobush
	Amelanchier alnifolia	Serviceberry
	Artemisia tridentata	Big sagebrush
	Atriplex canescens	Four-winged saltbush
	Atriplex confertifolia	Shadscale
	Atriplex hymenelytra	Desert holly
	Ceanothus greggii	Ceanothus
	Cercocarpus intricatus	Little-leaved mountain mahogany
	Chrysothamnus nauseosus	Big rabbitbrush
	Chrysothamnus viscidiflorus	Little rabbitbrush
	Coleogyne ramosissima	Blackbrush
	Cowania mexicana	Cliff-rose
	Encelia farinosa	Brittle bush
	Encelia frutescens	Rayless encelia
	Ephedra nevadensis	Nevada joint fir
	Ephedra viridis	Mountain joint fir
	Eurotia lanata	Winter fat
	Garrya flavescens	Silk tassel
	Juniperus osteosperma	Juniper
	Pinus monophylla	Pinyon pine
	Purshia glandulosa	Antelope brush
Forbs	*Amsinckia* sp.	Fiddleneck
	Astragalus sp.	Loco weed
	Chaenactis sp.	Pincushion
	Eriogonum sp.	Buckwheat
	Erodium cicutarium	Heron's bill
	Euphorbia sp.	Spurge
	Penstemon sp.	Penstemon
	Sphaeralcea ambigua	Desert mallow
	Stanleya pinnata	Princess plume

APPENDIX N. BOTANICAL ANALYSES OF DESERT BIGHORN SHEEP RUMEN CONTENTS, 1976

Animal No.	Area of Collection	Plant Type	Plant Name	Percent of Ingesta
6	Sheep Range	Grasses	*Oryzopsis hymenoides*	9
			Unidentified species	6
		Shrubs	*Artemisia tridentata*	10
			Atriplex confertifolia	27
			Ceanothus greggii	9
			Eurotia lanata	15
			Unidentified species	13
		Forbs	*Eriogonum* sp.	4
			Unidentified species	7
15	Sheep Range	Grasses	*Oryzopsis hymenoides*	28
			Sitanion hystrix	19
			Stipa speciosa	8
			Unidentified species	5
		Shrubs	*Ambrosia dumosa*	8
			Atriplex confertifolia	2
			Ephedra nevadensis	2
			Unidentified species	3
		Forbs	*Eriogonum* sp.	1
			Sphaeralcea ambigua	21
			Unidentified species	3
18	Sheep Range	Grasses	*Oryzopsis hymenoides*	9
			Poa sp.	3
			Sitanion hystrix	16
			Unidentified species	13
		Shrubs	*Cercocarpus intricatus*	9
			Cowania mexicana	29
			Ephedra nevadensis	3
			Unidentified species	9
		Forbs	*Eriogonum* sp.	6
			Unidentified species	3
20	Sheep Range	Grasses	*Festuca* sp.	22
			Muhlenbergia sp.	19
			Oryzopsis hymenoides	14
			Unidentified species	17

APPENDIX N. BOTANICAL ANALYSES OF DESERT BIGHORN SHEEP RUMEN CONTENTS, 1976 (continued)

Animal No.	Area of Collection	Plant Type	Plant Name	Percent of Ingesta
20	Sheep Range	Shrubs	*Encelia farinosa*	6
			Unidentified species	3
		Forbs	*Astragalus* sp.	4
			Eriogonum sp.	2
			Unidentified species	13
23	Sheep Range	Grasses	*Oryzopsis hymenoides*	28
			Poa sp.	7
			Sitanion hystrix	8
			Unidentified species	12
		Shrubs	*Artemisia tridentata*	4
			Atriplex confertifolia	2
			Atriplex sp.	3
			Coleogyne ramosissima	1
			Unidentified species	21
		Forbs	*Eriogonum* sp.	2
			Euphorbia sp.	3
			Unidentified species	9
24	Sheep Range	Grasses	*Oryzopsis hymenoides*	57
			Sitanion hystrix	12
			Unidentified species	3
		Shrubs	*Atriplex canescens*	4
			Atriplex confertifolia	1
			Atriplex hymenelytra	12
			Purshia glandulosa	7
			Unidentified species	1
		Forbs	*Eriogonum* sp.	2
			Unidentified species	1
27	Sheep Range	Grasses	*Muhlenbergia porteri*	17
			Oryzopsis hymenoides	26
			Poa sp.	12
			Sitanion hystrix	31
			Unidentified species	5
		Shrubs	Unidentified species	4

APPENDIX N. BOTANICAL ANALYSES OF DESERT BIGHORN SHEEP RUMEN CONTENTS, 1976 (continued)

Animal No.	Area of Collection	Plant Type	Plant Name	Percent of Ingesta
27	Sheep Range	Forbs	*Chaenactis* sp.	T
			Eriogonum sp.	1
			Unidentified species	4
28	Sheep Range	Grasses	*Oryzopsis hymenoides*	19
			Sitanion hystrix	36
			Unidentified species	8
		Shrubs	*Atriplex* sp.	1
			Ceanothus greggii	1
			Cercocarpus intricatus	6
			Cowania mexicana	19
			Juniperus osteosperma	T
			Pinus monophylla	2
			Unidentified species	6
		Forbs	Unidentified species	2
8	Black Mountains	Grasses	*Oryzopsis hymenoides*	13
			Sitanion hystrix	19
			Unidentified species	13
		Shrubs	*Atriplex canescens*	2
			Chrysothamnus nauseosus	5
			Coleogyne ramosissima	1
			Ephedra viridis	1
			Garrya flavescens	7
			Unidentified species	16
		Forbs	*Chaenactis* sp.	2
			Eriogonum sp.	6
			Euphorbia sp.	3
			Unidentified species	12
11	Black Mountains	Grasses	*Oryzopsis hymenoides*	21
			Sitanion hystrix	16
			Unidentified species	10
		Shrubs	*Ambrosia dumosa*	11
			Ephedra nevadensis	6
			Eurotia lanata	6
			Unidentified species	10

APPENDIX N. BOTANICAL ANALYSES OF DESERT BIGHORN SHEEP RUMEN CONTENTS, 1976 (continued)

Animal No.	Area of Collection	Plant Type	Plant Name	Percent of Ingesta
11	Black Mountains	Forbs	*Chaenactis* sp.	4
			Eriogonum sp.	4
			Euphorbia sp.	4
			Sphaeralcea ambigua	3
			Unidentified species	5
14	Black Mountains	Grasses	*Oryzopsis hymenoides*	24
			Sitanion hystrix	9
			Unidentified species	14
		Shrubs	*Ambrosia dumosa*	14
			Atriplex confertifolia	1
			Encelia sp.	3
			Unidentified species	6
		Forbs	*Astragalus* sp.	3
			Euphorbia sp.	8
			Sphaeralcea ambigua	6
			Unidentified species	12
2	Meadow Valley	Grasses	*Oryzopsis hymenoides*	31
			Sitanion hystrix	10
			Unidentified species	8
		Shrubs	*Atriplex canescens*	8
			Eurotia lanata	14
			Unidentified species	6
		Forbs	*Chaenactis* sp.	3
			Eriogonum sp.	13
			Sphaeralcea ambigua	1
			Unidentified species	6
21	Meadow Valley	Grasses	*Hilaria rigida*	6
			Oryzopsis hymenoides	13
			Poa sp.	3
			Sitanion hystrix	26
			Unidentified species	8
		Shrubs	*Encelia frutescens*	26
			Ephedra nevadensis	2

APPENDIX N. BOTANICAL ANALYSES OF DESERT BIGHORN SHEEP RUMEN CONTENTS, 1976 (continued)

Animal No.	Area of Collection	Plant Type	Plant Name	Percent of Ingesta
21	Meadow Valley	Forbs	*Chaenactis* sp.	2
			Eriogonum sp.	T
			Euphorbia sp.	2
			Sphaeralcea ambigua	10
			Unidentified species	2
26	Muddy Mountains	Grasses	*Oryzopsis hymenoides*	12
			Sitonion hystrix	32
			Unidentified species	4
		Shrubs	*Atriplex canescens*	1
			Cercocarpus intricatus	17
			Cowania mexicana	5
			Ephedra nevadensis	14
			Pinus monophylla	T
			Unidentified species	6
		Forbs	*Eriogonum* sp.	1
			Euphorbia sp.	2
			Unidentified species	6
16	Pint Waters Range	Grasses	*Oryzopsis hymenoides*	8
			Sitanion hystrix	18
			Stipa speciosa	5
			Unidentified species	10
		Shrubs	*Ceanothus* sp.	15
			Chrysothamnus sp.	5
			Encelia sp.	10
			Unidentified species	19
		Forbs	*Chaenactis* sp.	2
			Eriogonum sp.	T
			Unidentified species	8
17	Pint Waters Range	Grasses	*Orhyzopsis hymenoides*	5
			Sitanion hystrix	64
			Stipa speciosa	1
			Unidentified species	4
		Shrubs	*Ceanothus greggii*	12
			Encelia farinosa	2
			Unidentified species	4

APPENDIX N. BOTANICAL ANALYSES OF DESERT BIGHORN SHEEP RUMEN CONTENTS, 1976 (continued)

Animal No.	Area of Collection	Plant Type	Plant Name	Percent of Ingesta
17	Pint Waters Range	Forbs	*Eriogonum* sp.	2
			Unidentified species	6
3	Las Vegas Range	Grasses	*Bromus tectorum*	3
			Hilaria jamesii	5
			Oryzopsis hymenoides	21
			Sitanion hystrix	30
		Shrubs	*Atriplex confertifolia*	2
			Cercocarpus intricatus	16
			Cowania mexicana	8
			Unidentified species	7
		Forbs	*Eriogonum* sp.	T
			Unidentified species	8
4	Las Vegas Range	Grasses	*Hilaria jamesii*	4
			Orhyzopsis hymenoides	38
			Sitanion hystrix	11
			Stipa speciosa	3
			Unidentified species	16
		Shrubs	*Atriplex canescens*	9
			Cercocarpus intricatus	8
			Unidentified species	4
		Forbs	*Chaenactis* sp.	4
			Eriogonum sp.	T
			Unidentified species	3
7	Las Vegas Range	Grasses	*Oryzopsis hymenoides*	47
			Sitanion hystrix	26
			Unidentified species	8
		Shrubs	*Amelanchier alnifolia*	2
			Cercocarpus intricatus	2
			Coleogyne ramosissima	1
			Unidentified species	7
		Forbs	*Chaenactis* sp.	2
			Eriogonum sp.	2
			Unidentified species	3

APPENDIX N. BOTANICAL ANALYSES OF DESERT BIGHORN SHEEP RUMEN CONTENTS, 1976 (continued)

Animal No.	Area of Collection	Plant Type	Plant Name	Percent of Ingesta
12	Lone Mountain	Grasses	*Hilaria jamesii*	18
			Sitanion hystrix	34
			Unidentified species	6
		Shrubs	*Artemisia tridentata*	11
			Ceanothus sp.	7
			Purshia glandulosa	9
			Unidentified species	8
		Forbs	*Chaenactis* sp.	1
			Euphorbia sp.	3
			Unidentified species	3
19	Lone Mountain	Grasses	*Bromus tectorum*	6
			Hilaria jamesii	3
			Oryzopsis hymenoides	17
			Sitanion hystrix	36
			Unidentified species	8
		Shrubs	*Artemisia tridentata*	12
			Atriplex confertifoli	2
			Purshia glandulosa	12
		Forbs	*Sphaeralcea* sp.	2
			Unidentified species	2
9	Eldorado Mountains	Grasses	*Oryzopsis hymenoides*	18
			Sitanion hystrix	8
			Stipa speciosa	3
			Unidentified species	14
		Shrubs	*Atriplex canescens*	7
			Chrysothamnus viscidiflorus	1
			Unidentified species	12
		Forbs	*Eriogonum* sp.	1
			Euphorbia sp.	15
			Penstemon sp.	3
			Stanleya pinnata	7
			Unidentified species	11

APPENDIX N. BOTANICAL ANALYSES OF DESERT BIGHORN SHEEP RUMEN CONTENTS, 1976 (continued)

Animal No.	Area of Collection	Plant Type	Plant Name	Percent of Ingesta
13	Eldorado Mountains	Grasses	*Festuca* sp.	2
			Poa sp.	6
			Sitanion hystrix	36
			Unidentified species	8
		Shrubs	*Ambrosia dumosa*	17
			Unidentified species	13
		Forbs	*Amsinckia* sp.	7
			Eriogonum sp.	T
			Sphaeralcea ambigua	1
			Unidentified species	10
1	Mormon Mountain	Grasses	*Oryzopsis hymenoides*	13
			Sitanion hystrix	18
			Unidentified species	9
		Shrubs	*Atriplex canescens*	4
			Cercocarpus intricatus	39
			Ephedra nevadensis	2
			Unidentified species	9
		Forbs	*Eriogonum* sp.	3
			Unidentified species	3
10	Mormon Mountain	Grasses	*Hilaria rigida*	4
			Oryzopsis hymenoides	26
			Poa sp.	7
			Sitanion hystrix	19
			Unidentified species	14
		Shrubs	*Atriplex canescens*	15
			Unidentified species	2
		Forbs	*Astragalus* sp.	2
			Chaenactis sp.	T
			Erodium cicutarium	2
			Sphaeralcea ambigua	2
			Unidentified species	7
22	Highland Range	Grasses	*Sitanion hystrix*	29
			Unidentified species	7

APPENDIX N. BOTANICAL ANALYSES OF DESERT BIGHORN SHEEP RUMEN CONTENTS, 1976 (continued)

Animal No.	Area of Collection	Plant Type	Plant Name	Percent of Ingesta
22	Highland Range	Shrubs	*Cercocarpus intricatus*	19
			Coleogyne ramosissima	4
			Cowania mexicana	17
			Eurotia lanata	4
			Unidentified species	7
		Forbs	*Eriogonum* sp.	3
			Euphorbia sp.	2
			Unidentified species	8

T = Trace, less than 1 percent